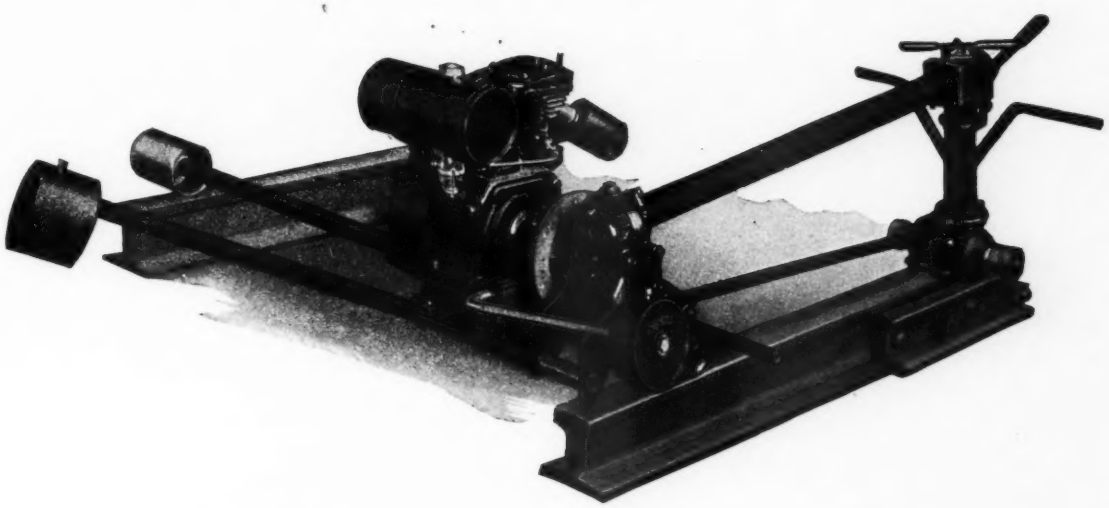

STANDARD PROTECTION FOR SAFETY AND SPEED
RAIL ANTI-CREEPERS

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933 at the postoffice at Chicago, Illinois, under the act of March 3, 1879, with additional entry at Mt. Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

Savings Possible by the use of 2 Raco Power Track Machines



OPERATION	Savings Per Joint	Savings Per Day	Miles of Track to Accomplish These Savings	Days Required to Return Cost of 2 RPTM's Out of Savings
RAIL LAYING	$0.13	$35.00	47	47
CHANGING ANGLE BARS	0.181	34.75	34	48
SHIMMING	0.084	31.50	73	53
TIGHTENING OUT OF FACE	0.038	30.40	160	54

These savings are over and above well organized hand methods and are based upon **below average production** for 2 machines per 8 hour day.

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE
405 LEXINGTON AVENUE
(Chrysler Building)
NEW YORK

The NORDBERG SPIKE PULLER

Sets a faster pace for the rail laying gang

The Complete Line of Nordberg Track Tools

Power Jack	Track Wrench
Adzing Machine	Spike Puller
Surface Grinder	Precision Grinder
Utility Grinder	Rail Drill
Track Shifter	

Rapid progress of the rail laying gang is dependent on quickly removing the spikes and getting out the old rail. Pulling spikes by hand is slow, especially if hard to pull, if "cut-throat," or "hump-backed," or if the heads are badly corroded. At bridges, trestles and switches, hand pulling is particularly difficult. With the Nordberg Spike Puller, any spike accessible to the tongs can be pulled. Not only does the machine eliminate delays caused by unfavorable conditions but, by pulling spikes at the rate of 35 to 45 per minute, it sets a faster pace for the rail laying gang, increases the daily progress and lowers the cost of laying steel. Nordberg Spike Pullers at the head of the gang mean a fast moving gang.

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

Export Representative—WONHAM Inc.—44 Whitehall St., New York

Years Ahead in Design

FAIRMONT CARS HAVE THE FEATURES WHICH SERVE YOU BEST

Performance ON THE JOB COUNTS

THE *Fairmont* BELT DRIVE KEEPS CARS MOVING . . . CUTS COSTS

Five belts shown above were used on section cars and averaged 23,560 miles each in four years and two months.

Many roads report belt mileage on inspection cars ranging from 35,000 to 40,000 miles.

Fairmont tests every endless cord belt to insure true running, resistance to stretch, and accurate lengths.

Fairmont endless cord belts have proved four times as strong as belts with laced joint and fourteen times stronger than the average running tension to which they are subjected in service. As a result, Fairmont endless cord belts last an amazingly long time.

The superior efficiency of the Fairmont Endless Cord Belt Drive has been proved on thousands of cars over a long period of years. Its great strength and slow-wearing durability practically eliminate breakdowns on the road . . . Timken bearings in the idler pulley, which controls belt tension, assure smooth, easy starting of the most heavily loaded cars . . . Consisting of only the endless cord belt, belt lever and three pulleys, the Fairmont Belt Drive is the simplest of all transmissions to maintain.

Simplicity and durability have always characterized Fairmont design. They underlie the remarkable economy records established by Fairmont Motor Cars under all conditions of service. There is a Fairmont Car for every requirement. Write for catalogs. Fairmont Railway Motors, Inc., Fairmont, Minnesota.

OF ALL THE CARS IN SERVICE TODAY

MORE THAN HALF ARE FAIRMONTS

Moving Right Along With I-R Air Tools

EFFICIENT and economical maintenance of track is readily accomplished with the aid of I-R Air Tools. From the compressor to the tamper an uninterrupted flow of uniform power is provided as the work progresses mile after mile.

I-R Crawl-Air Compressors are the latest contribution to portable power production in maintenance of way work. They deliver 23% more air than corresponding piston displacement single stage machines with saving of 25-65% fuel cost per cubic foot . . . And in conjunction with MT-3 Low Air Consumption Tie Tampers you get at least 33-1/3% more work for the amount of air or fuel formerly consumed.

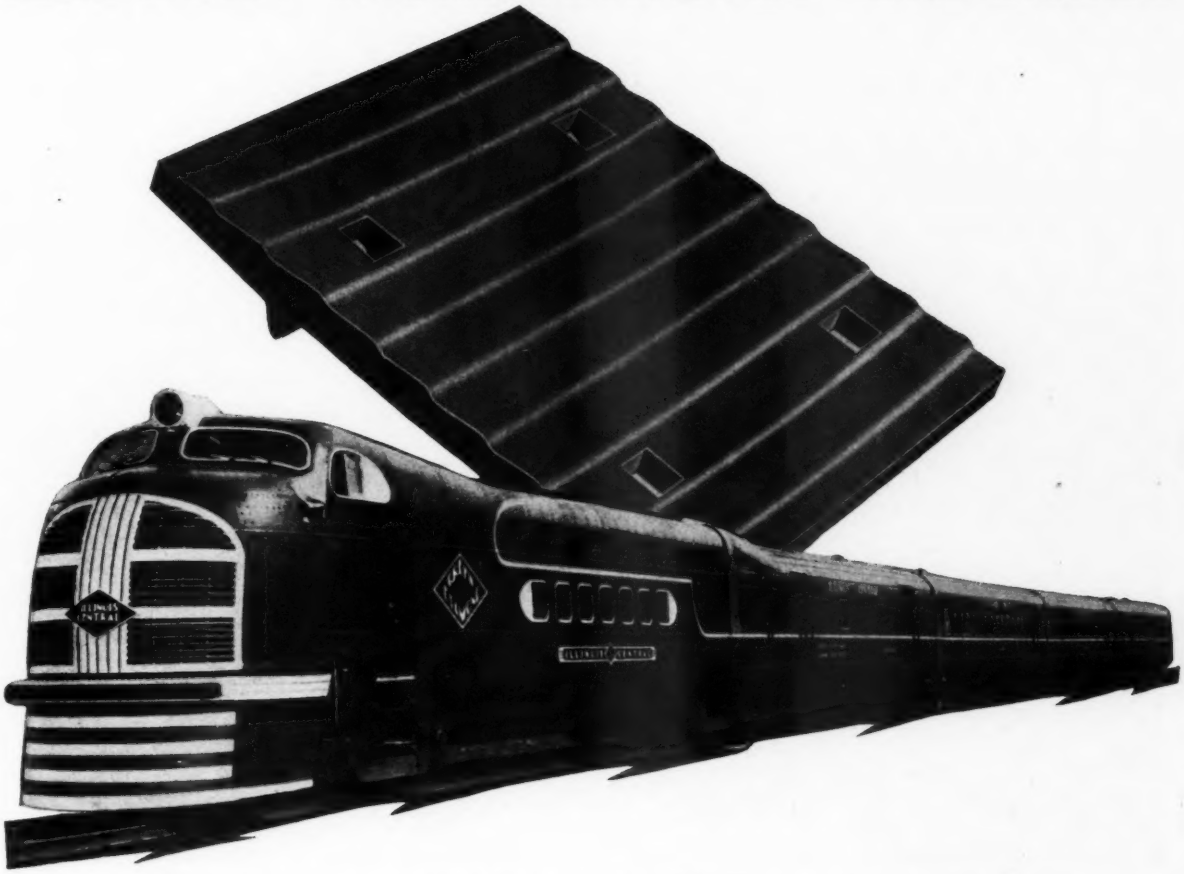
Atlanta, Birmingham, Boston, Buffalo, Butte, Chicago, Cincinnati, Cleveland, Dallas, Denver, Detroit, Duluth, El Paso, Hartford, Houston, Kansas City, Knoxville, Los Angeles, Newark, New York, Philadelphia, Picher, Pittsburgh, Pottsville, Salt Lake City, San Francisco, Scranton, Seattle, St. Louis, Tulsa, Washington

Ingersoll-Rand

11 BROADWAY NEW YORK CITY

678 11

REDUCES MAINTENANCE EXPENSES



Prolongs Life of Ties and Rail

THE Lundie Tie Plate with its rounded steps of resistance holds track to gauge, and, most important of all, accomplishes this without injuring a single fibre of the tie. This scientifically designed plate provides tremendous holding power against plate movement and consequent spreading of track. The plate seats itself perfectly and gives proper inclination to rail so that wheels track properly . . . Lundie Plates are made with single or double shoulders to comply with A.R.E.A. specifications, or can be supplied to meet your own specifications. In preparing your 1939 budget, be sure to specify Lundie Tie Plates. They assure maximum return from investment in ties and rail.

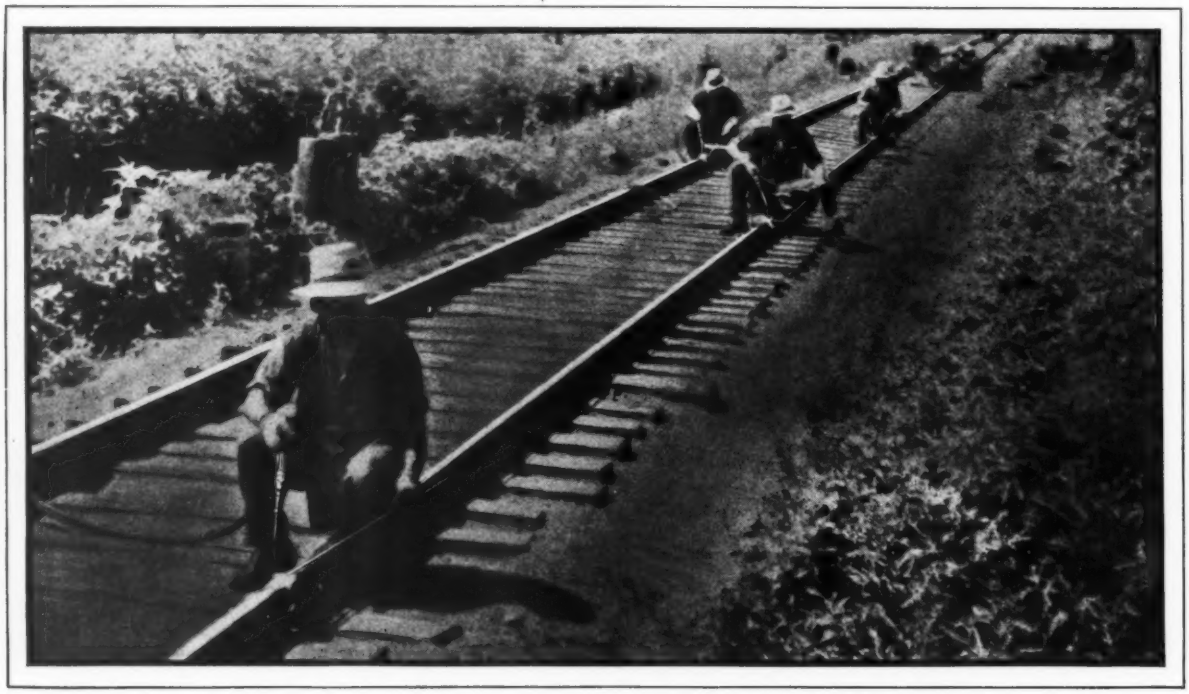
THE LUNDIE ENGINEERING CORPORATION

Tie Plates—Spring Rail Clips—Safety Tongs for Handling Track Materials

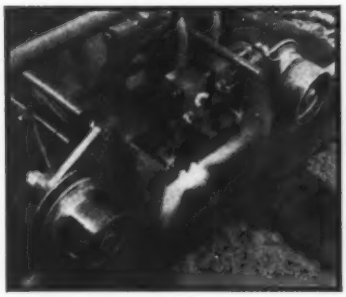
19 West 50th St., New York **59 E. Van Buren St., Chicago**

LUNDIE TIE PLATE

Maintenance-of-Way



Building up battered rail ends the Oxweld way makes old rail ride like new and lengthens its service life at a fraction of the cost of rail replacement.



Hardening the ends of new rail by Oxweld methods retards batter and lowers maintenance costs.

Reclaiming worn switch points by oxy-acetylene welding restores them to service at low cost.

Piping installed under Oxweld procedures is smooth inside and out, strong, and leakproof.

Costs can be Reduced

by using OXWELD PROCEDURES

The accompanying illustrations show a few of the many procedures developed by The Oxweld Railroad Service Company for speeding up and reducing costs in maintenance-of-way and railroad construction work. Other important Oxweld procedures for maintenance-of-way include building up worn crossings, frogs, joint bars, and car-retarder parts, and installing signal bonds.

Co-ordinated Facilities

In the development of these procedures, The Oxweld Railroad Service Company co-ordinates for the railroads the manufacturing, research, engineering, and service facilities of those Units of Union Carbide and Carbon Corporation which produce apparatus and supplies for oxy-acetylene welding, cutting, and heat-treating. In addition to supplying the necessary materials, Oxweld provides supervision and instruction through its field organization composed of railroad-trained men.

Years of Experience

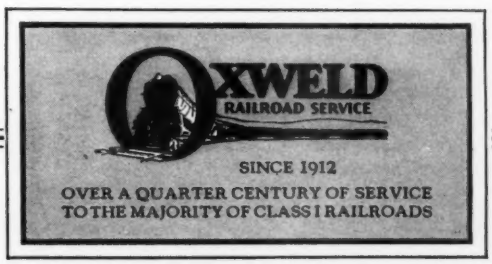
Improved methods and new applications of the oxy-acetylene process backed by years of experience are made available as they are developed to meet changing requirements. Oxweld procedures have proved so effective in railroad maintenance that now more than half of the total mileage of track in the United States is maintained more economically through the use of these methods.

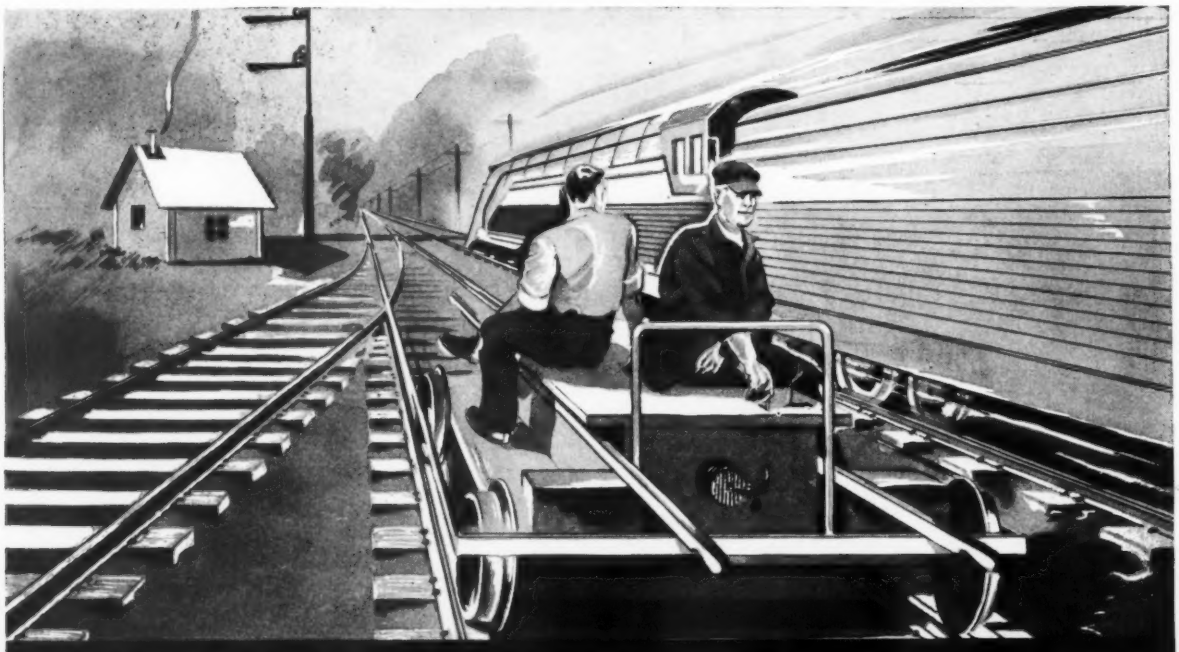
THE OXWELD RAILROAD SERVICE COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

Carbide and Carbon Building, Chicago and New York





PUT YOUR SECTION CARS ON A PAR WITH MODERN TRAINS

TIMKEN Tapered Roller BEARING EQUIPPED

A symbol of quality for any piece of equipment with which it is associated

TIMKEN Bearings protect running gear against radial, thrust and combined loads. They eliminate friction, prevent wear on axles and hold wheels in correct alignment.

TIMKEN Bearings are used on all of the locomotives and many of the cars of the new 20th CENTURY LIMITED.

Timken Bearing Equipped section cars and trailers run smoothly and steadily—loaded or light with the further advantage that heavier loads can be safely carried at higher speeds.

The same bearing that has proved so successful on the driving axles of the world's largest locomotives, cars and streamlined trains is the bearing for your section motor cars and trailers. Specify "Timken Bearing Equipped".

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

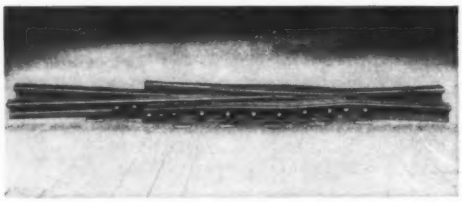
Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; TIMKEN Rock Bits; and TIMKEN Fuel Injection Equipment.

TIMKEN
TAPERED ROLLER BEARINGS

PETTIBONE

Asselin Permanent Base Rubber Cushioned Crossing

Open Hearth Rail Crossings



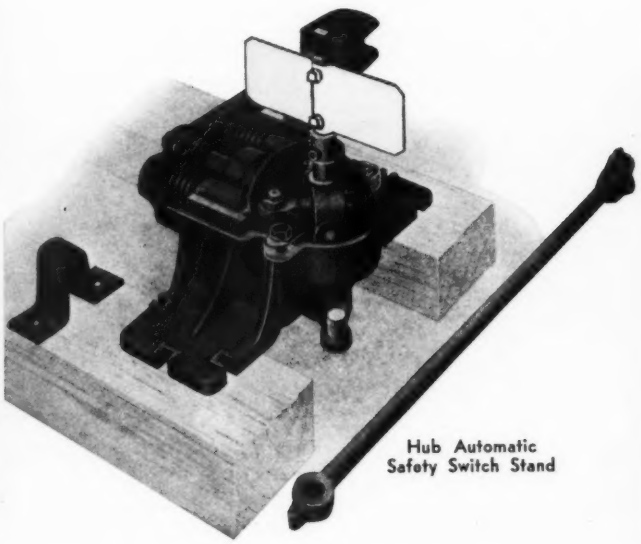
Rail Bound Manganese Steel Frog

For many years it has been our practice to use first-quality rails exclusively in frog, switch and crossing construction, **eliminating** all "A" and No. 2 rails.

In addition, we have, during the last year, used only control cooled rails for all 90-lb. and heavier, sections. This policy will be rigidly maintained in the future.

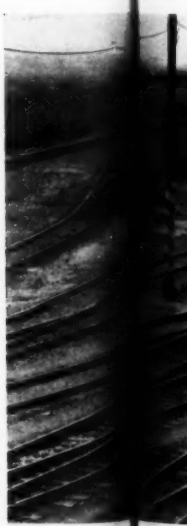
These measures illustrate the care taken to insure the highest standards of construction.

Switch Stand and Switch Point Lock



Hub Automatic Safety Switch Stand

Mechanical Switchman



PETTIBONE MULLIKEN COR 4

MULLIKEN

Builders of Quality

TRACK MATERIALS

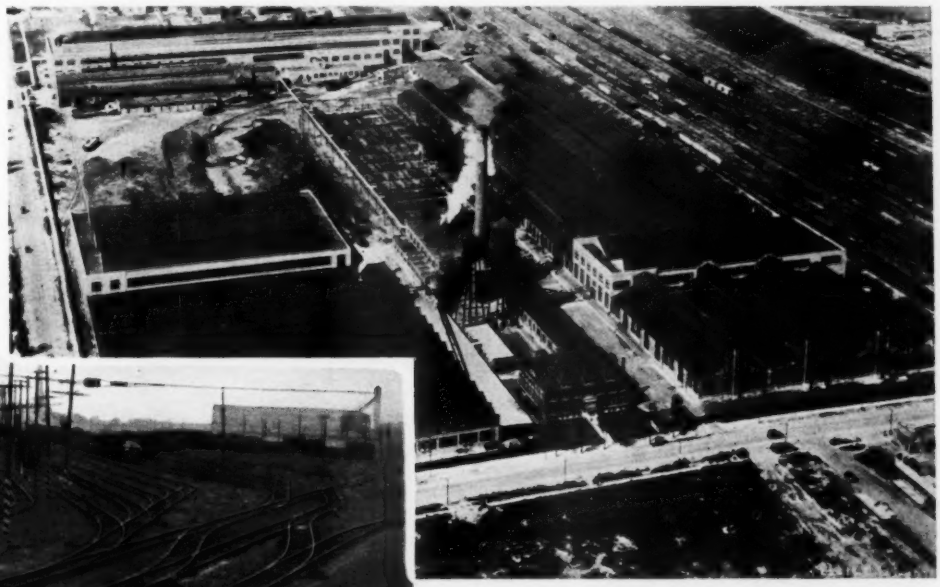
An organization having long, successful experience and an **undivided** management responsibility governing **all** research, engineering and manufacturing processes, is a most logical assurance of products that promote highest standards of safety and economy.

Every operation required to produce PETTIBONE MULLIKEN products is within **one plant.** We make, for example, our own manganese castings for crossings, frogs and guard rails . . . a guarantee of consistently high-grade performance and dependability.

We have served the railways continuously since 1880 . . . . when PETTIBONE MULLIKEN frogs and crossings were accepted standards of their time. In even greater measure, we are now prepared to meet your future needs.

PMCO

TRADE MARK REG. U.S. PAT. OFF.

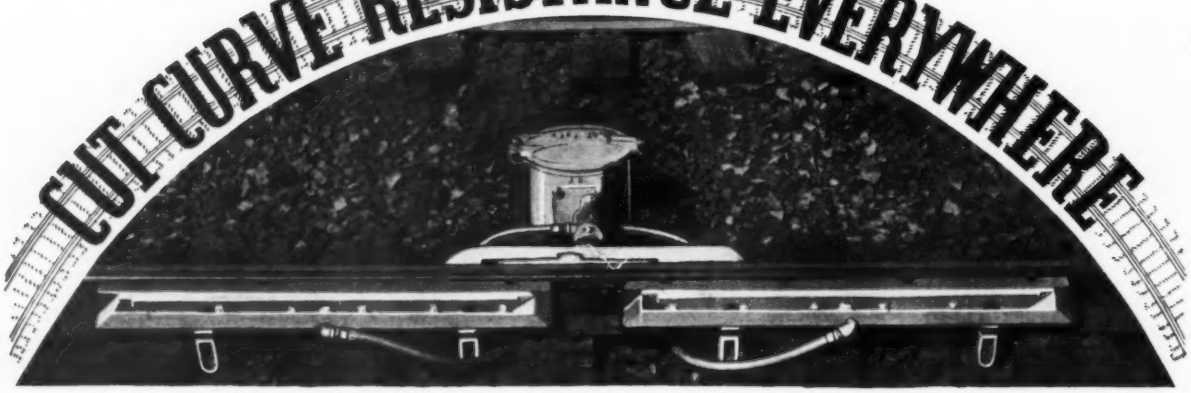


Above: The PETTIBONE MULLIKEN thirty-three acre plant is the largest single unit devoted to the production of track materials.

Left: Extensive reconstruction and modernization of the Clearing gravity classification yard of the Belt Railway of Chicago, included the installation of PETTIBONE MULLIKEN Hub Safety Automatic Switch Stands, No. 9 Manganese Frogs, Switches and Guard Rails.

4710 West Division St., Chicago, Ill.

CUT CURVE RESISTANCE EVERYWHERE



Standard Meco Lubricator installation for one-rail lubrication.

Curve friction plays no favorites. It occurs on all curves—in Yards or Sidings, or on main-line curves, whether simple, compounded or reverse.

No matter what the curve conditions, no matter how extensive or how complicated the curve territory, Meco Lubricators can be so installed that they reduce friction to the vanishing point and promote many economies, some of which are listed below.

MECO CURVE-RAIL AND WHEEL-FLANGE LUBRICATORS

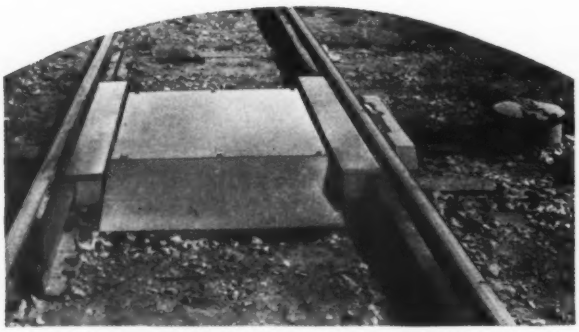
(Each Meco Serves a number of curves)

1. Practically eliminate curve-rail wear caused by wheel-flange friction, increasing curve-rail life 2 to 4 times.
2. Greatly prolong the life of high rail in curves otherwise scheduled for early replacement.
3. Decrease derailment hazards.
4. Increase life of low rail in curves, by allowing higher speeds and equalizing load on both rails. "Flowing" of low rails is reduced.
5. Reduce regauging and realigning costs.
6. Eliminate wheel screeching on curves.
7. Reduce wheel-flange wear, particularly noticeable on locomotive wheels.
8. Permit increased tonnage ratings through divisions where curvature governs such ratings.
9. Reduce fuel consumption.
10. Permit increased train speeds with safety.
11. Frequently do away with helper service.

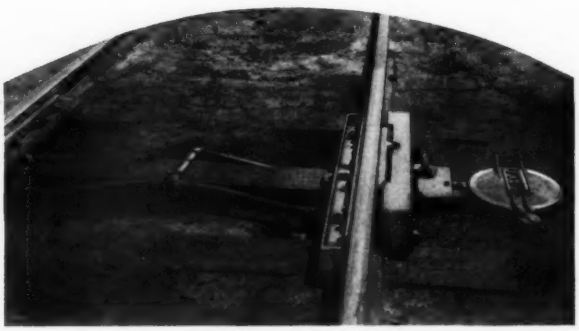
OVER 3500 MECOS ARE IN SERVICE ON MORE THAN 100 RAILROADS

MAINTENANCE EQUIPMENT CO.

RAILWAY EXCHANGE BUILDING CHICAGO, ILLINOIS

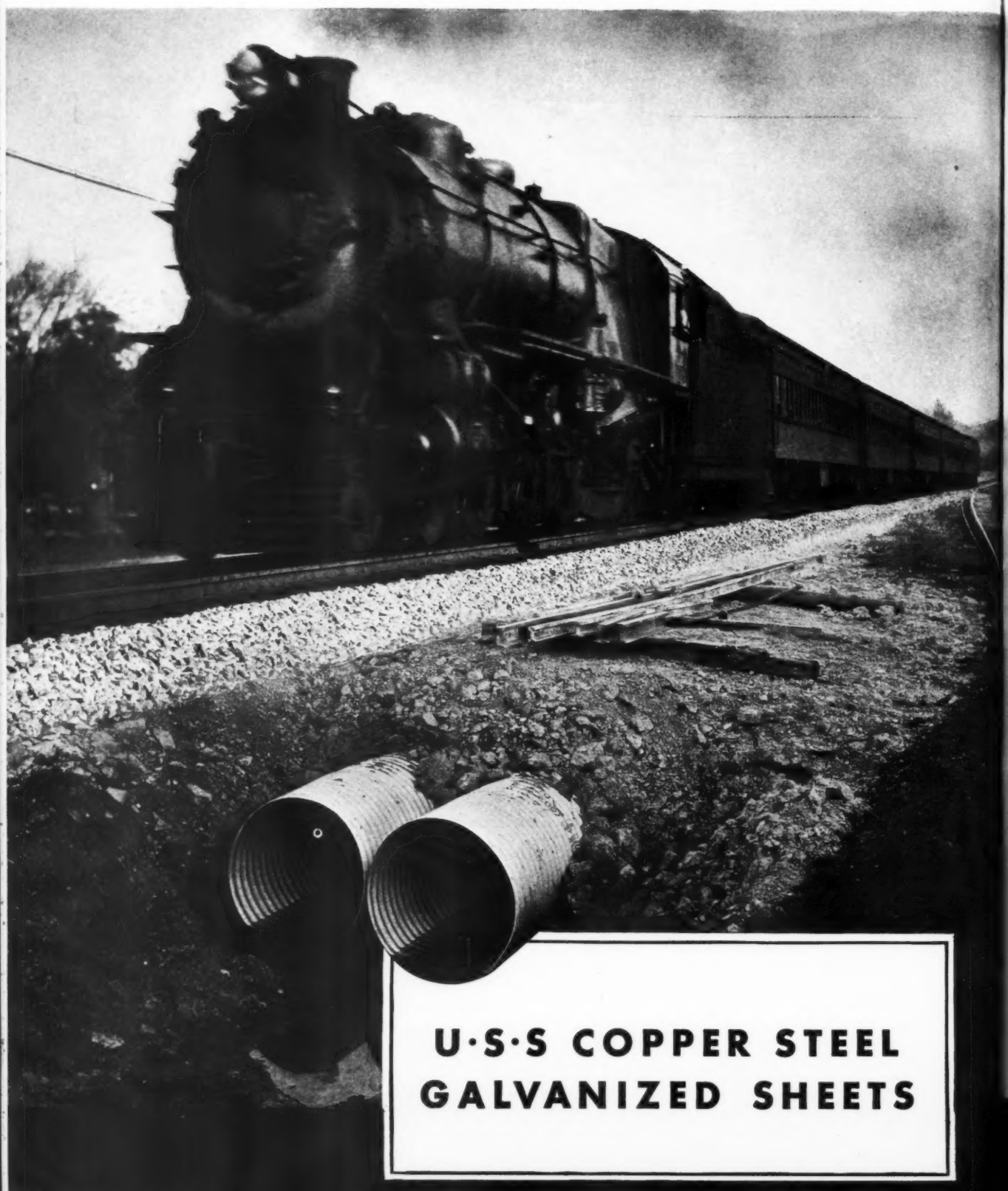


Meco Guard-Rail Lubricator. Two-rail installation for lubricating long guard rails.



Yard-Type Meco Lubricator for serving both right and left hand curves. Installed within the car line.

Why Copper Steel is the *Right*



U·S·S COPPER STEEL GALVANIZED SHEETS

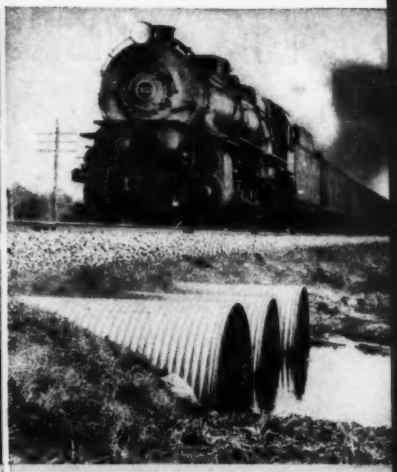
Material for Good Culverts

PERFORMANCE is the main objective in culvert installation—and the story of U·S·S Copper Steel is one of better performance at lower cost. The most convincing evidence of this is the fact that no culvert made of U·S·S Copper Steel has ever been known to fail structurally in service.

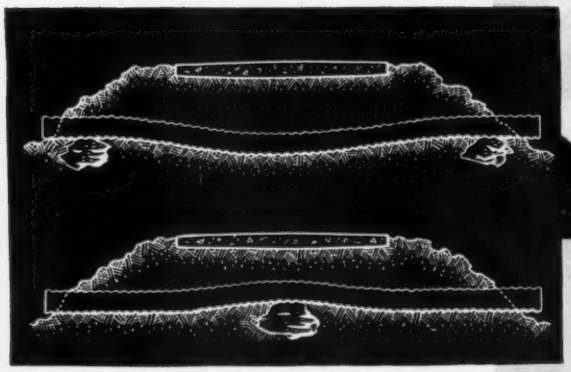
Copper Steel culverts are designed to resist such forces as sudden freezes, rapid thaws, sub-soil changes, heavy weight and vibration. They do not crack or fail under stresses that might destroy rigid materials.

Another strong advantage of U·S·S Copper Steel is its endurance. In 1911 U. S. Steel engineers discovered that a little copper added to steel more than doubles its resistance to rust and atmospheric corrosion under alternate wet and dry conditions. When galvanized, U·S·S Copper Steel has proved over a period of years to be a most enduring, low-cost culvert material.

COPPER STEEL RESISTS CORROSION. Countless installations and numerous tests conducted by independent testing laboratories show that U·S·S Copper Steel has the highest atmospheric corrosion resistance of any commercial culvert metals.



COPPER STEEL CULVERTS STAND UP under the constant pounding of traffic. The corrugations form strong repeated arches capable of carrying heavy loads.



NO CRACKING OR BREAKING from shifts in sub-soil. Corrugated culverts are built like accordions, with enough flexibility to adapt themselves to changing soil pressures without failure.

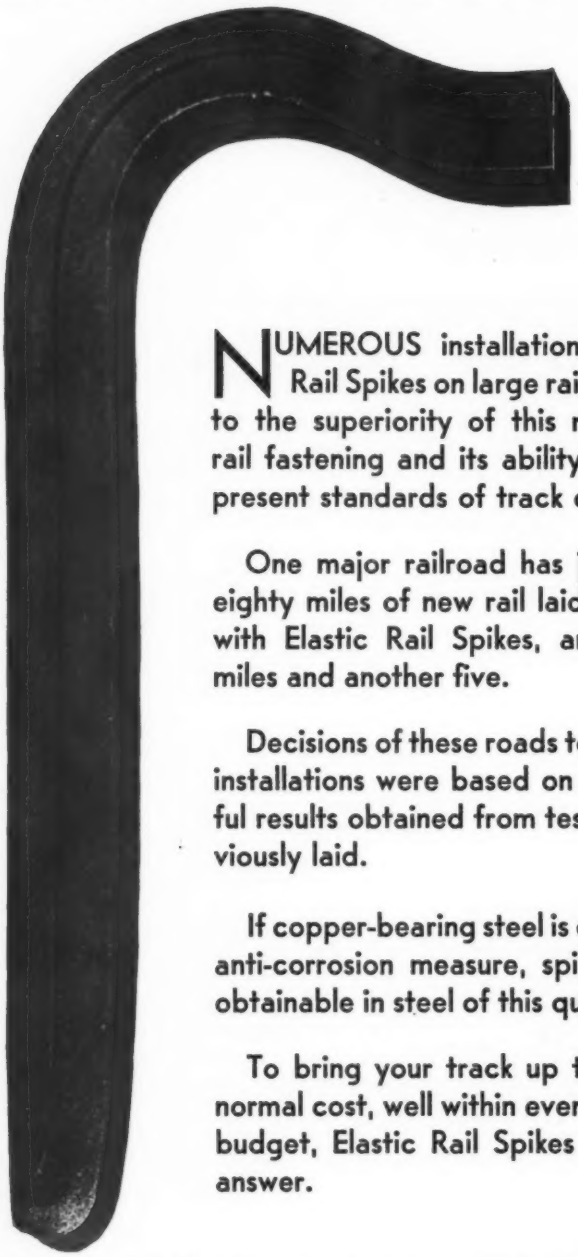
LOW INSTALLATION COST. Copper Steel culverts eliminate much expensive foundation and form work, can be handled with fewer men and do not require highly skilled labor.

TRAFFIC INTERRUPTIONS CAN BE PREVENTED. Copper Steel culverts are installed quickly and easily, often without stopping traffic. The result is substantial savings in time and labor costs.

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

THE *Elastic* RAIL SPIKE LOWERS MAINTENANCE COSTS



NUMEROUS installations of Elastic Rail Spikes on large railroads attest to the superiority of this new type of rail fastening and its ability to improve present standards of track construction.

One major railroad has just installed eighty miles of new rail laid out-of-face with Elastic Rail Spikes, another eight miles and another five.

Decisions of these roads to make these installations were based on the successful results obtained from test tracks previously laid.

If copper-bearing steel is desired as an anti-corrosion measure, spikes are now obtainable in steel of this quality.

To bring your track up to date at a normal cost, well within even a restricted budget, Elastic Rail Spikes provide the answer.

The outstanding benefits obtained when Elastic Rail Spikes are installed on your Road include:

Simplicity of design

Ease of application

Low first cost

Positive rail anchorage effect

Positive but resilient bond of track structure

Reduction of crosstie wear and of maintenance costs

Minimum number of track components

Quiet and smooth riding track

ELASTIC RAIL SPIKE CORPORATION

Affiliate of Bernuth, Lembcke Co., Inc.

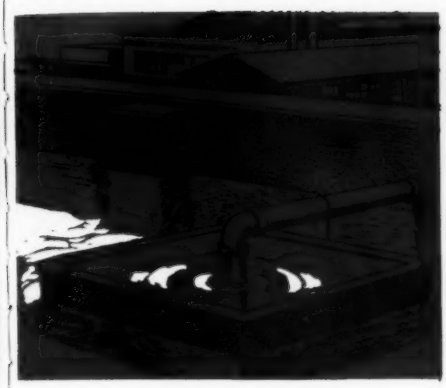
420 LEXINGTON AVENUE, NEW YORK

New York · Pittsburgh · Houston · London

STOP THAT Ever-rising MAINTENANCE EXPENSE

"MAINTENANCE EXPENSE for these flat roofs used to be quite an item. But we've found a way of beating it. We use Koppers Roofs now. They withstand the severest weather conditions.

"WE PUT KOPPERS ROOFS on our old buildings as well as new ones, to avoid repair work. Slight cracks are closed by the 'cold flow' of the coal tar pitch. Leaks which might cause costly damage to goods are prevented.



"ONE OF THE BEST proofs that coal tar pitch resists the prolonged action of water is the fact that Koppers Roofs are used for cooling water from air conditioning systems. Any roof that will stand that kind of treatment is a safe one for us.

"THESE COAL TAR PITCH ROOFS are giving us the best kind of protection against damage claims in our warehouses. Since we have become 'roof conscious' we appraise our buildings from the roof down.

"STANDARDIZING on Koppers Roofs is just another one of the many advances we have made since the first steam engine was built. A knowledge of roofing means more profitable railroading."

We shall be glad to send you detailed specifications on the use of Koppers Coal Tar Pitch and Tarred Felt for Railroad Buildings.

KOPPERS PRINCIPAL PRODUCTS FOR THE RAILROAD FIELD

Bituminous-base Paints . . . Coal . . . Coal Handling Plants . . . Coal Washing Systems . . . Coke . . . Pressure-treated Ties, Poles, Posts and other Treated Timber . . . Roofing . . . Creosote . . . Deodorants . . . D-H-S Bronze Castings and Iron Castings . . . Disinfectants . . . Fast's Self-aligning Couplings . . . Western Fire Hydrants . . . Insecticides . . . Locomotive Cylinder Packing . . . American Hammered Piston Rings . . . Pipe . . . Tanks . . . Tarmac for Paving . . . Waterproofing . . . Weed Killers

KOPPERS COMPANY · TAR AND CHEMICAL DIVISION · PITTSBURGH, PENNA.

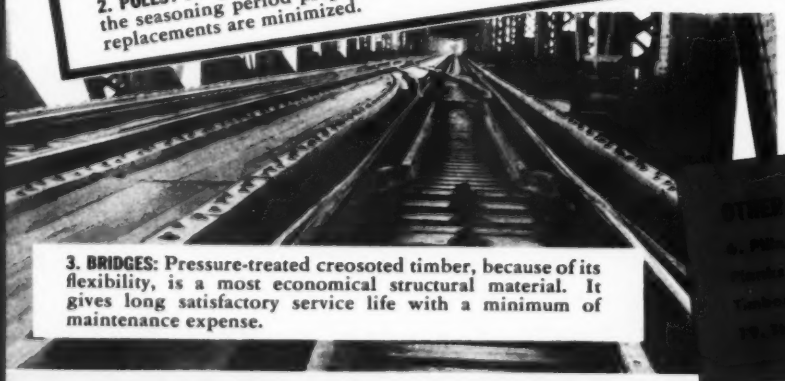
a KOPPERS product

In how many places (besides ties) do you use Pressure-Treated Timber?

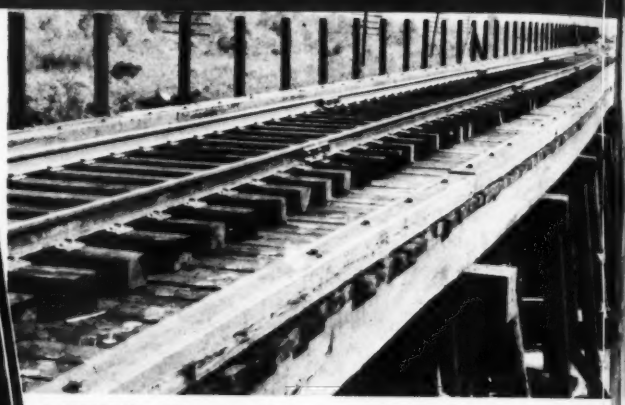
Timber that has been pressure-treated with creosote has proved itself to be the most satisfactory material for cross ties. And because of its usefulness in that field, railroads have adopted it for many other structural purposes. Write for information on the use of pressure-treated timber for your specific construction work.

1. PLATFORMS: Facilities are available at plants of The Wood Preserving Corporation for framing before treatment. This is done in accordance with your detailed specifications.

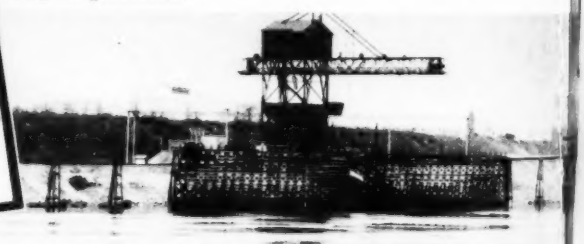
2. POLES: Proper stacking for air seasoning and careful supervision during the seasoning period prepare WPC poles for full-length treatment. Costly replacements are minimized.



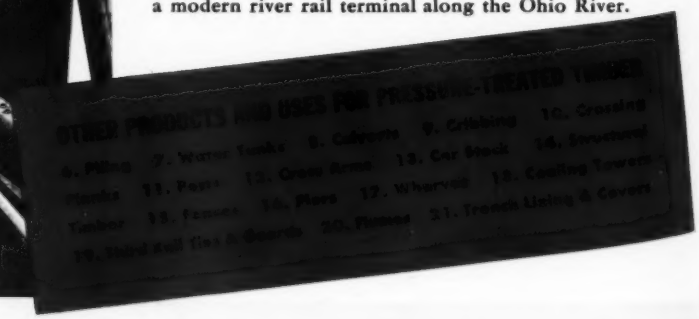
3. BRIDGES: Pressure-treated creosoted timber, because of its flexibility, is a most economical structural material. It gives long satisfactory service life with a minimum of maintenance expense.



4. TRESTLES: When trestles are built of pressure-treated timber, they resist the attacks of time, weather, moisture and insects. Structural weaknesses due to decay are prevented.



5. DOCKS: Docks of pressure-treated timber are protected against the destructive chemicals often found in lake, river, and sea water. The illustration shows a modern river rail terminal along the Ohio River.

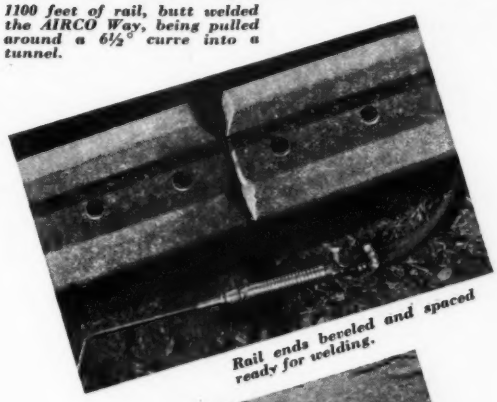


THE WOOD PRESERVING CORPORATION

PITTSBURGH, PA.

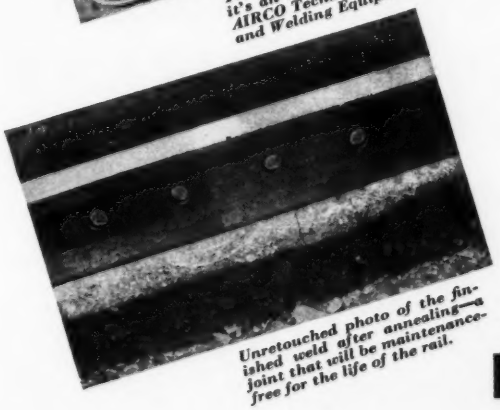
a KOPPERS subsidiary

1100 feet of rail, butt welded the AIRCO Way, being pulled around a 6½° curve into a tunnel.



Rail ends beveled and spaced ready for welding.

The actual welding is easy when it's an ALL-AIRCO job—using AIRCO Technique, Rods, Gases and Welding Equipment.



Unretouched photo of the finished weld after annealing—a joint that will be maintenance-free for the life of the rail.

The AIRCO Method of BUTT WELDING Rails *. . . gives better results with less labor.*

A properly welded rail joint requires no maintenance. That's why it is a growing MW practice to BUTT WELD rail in tunnels, at highway and street crossings, at stations and at other points where conditions cause excessive costs in the maintenance of the ordinary rail joint.

When it comes to the actual BUTT WELDING operation, MW men are finding that it pays to use the AIRCO Oxyacetylene Method. It's a tried-and-proved method that not only assures a sound, stress-free joint, but also saves on time and labor.

Our MW field engineers will be glad to present the facts about this better, more economical AIRCO Method of Butt Welding to any MW department head. No obligation. Write for them.

AIR REDUCTION

SALES COMPANY

General Offices: 60 East 42nd St., New York, N. Y.

DISTRICT OFFICES IN PRINCIPAL CITIES

SERVING RAILROADS FROM COAST TO COAST

The BARCO type K-1 Unit Tytamper is a logical development of the BARCO type TT-2 heavy duty tytamper and the BARCO H-6 and J-2 Unit Hammers, which have given exceptional service during the past three years with extraordinarily low cost of operation and maintenance.

Thirty-four railroads have purchased and are using BARCO Gasoline Hammers and Tytampers.

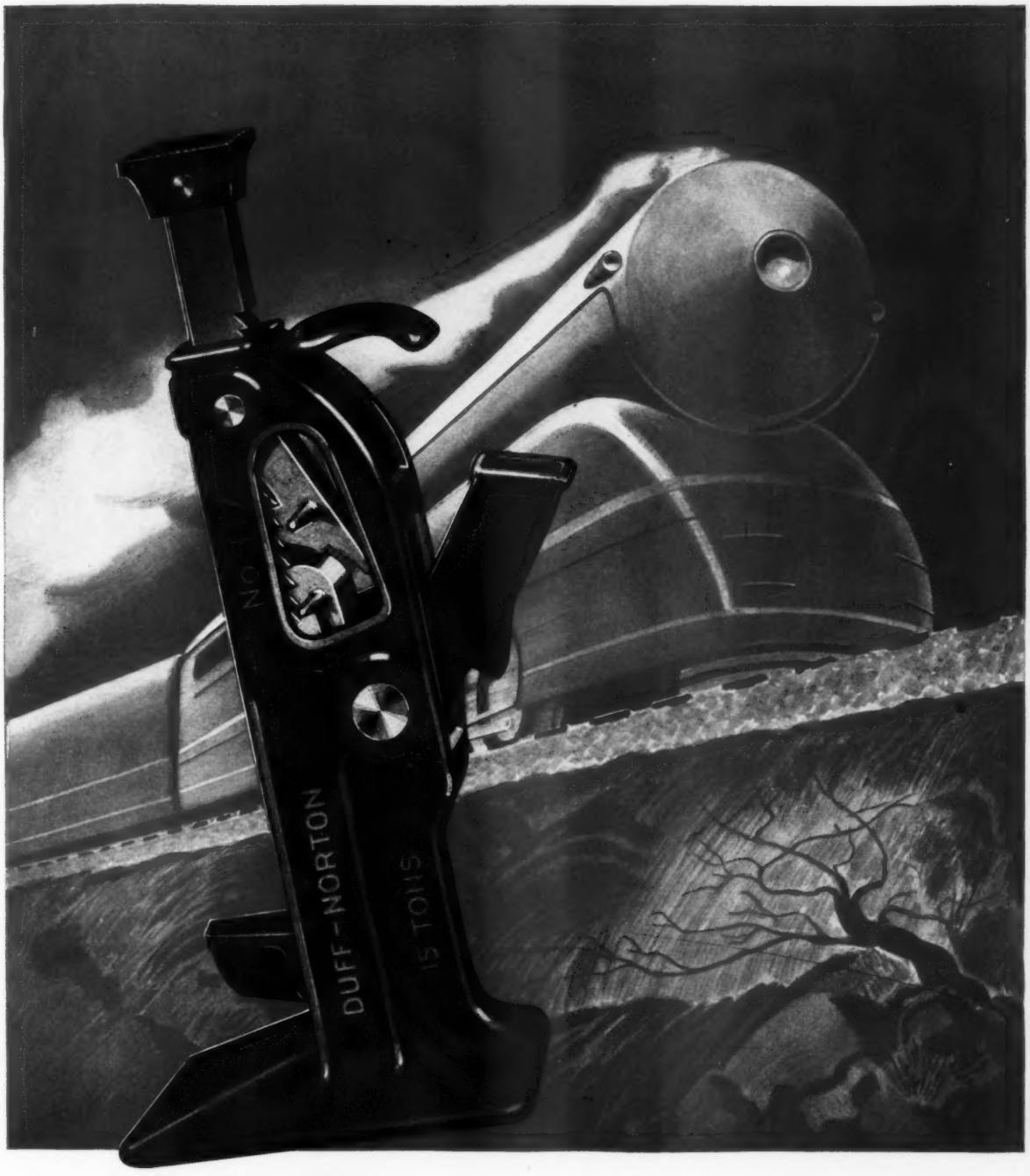
Exhibited in Space 75, Roadmasters Convention, Hotel Stevens, September, 1938.

BARCO MANUFACTURING COMPANY

1805 W. Winnemac Ave., Chicago, Ill.

THE HOLDEN CO.,
IN CANADA
MONTREAL—MONCTON—TORONTO—WINNIPEG—VANCOUVER

BARCO UNIT TYTAMPER



Duff-Norton

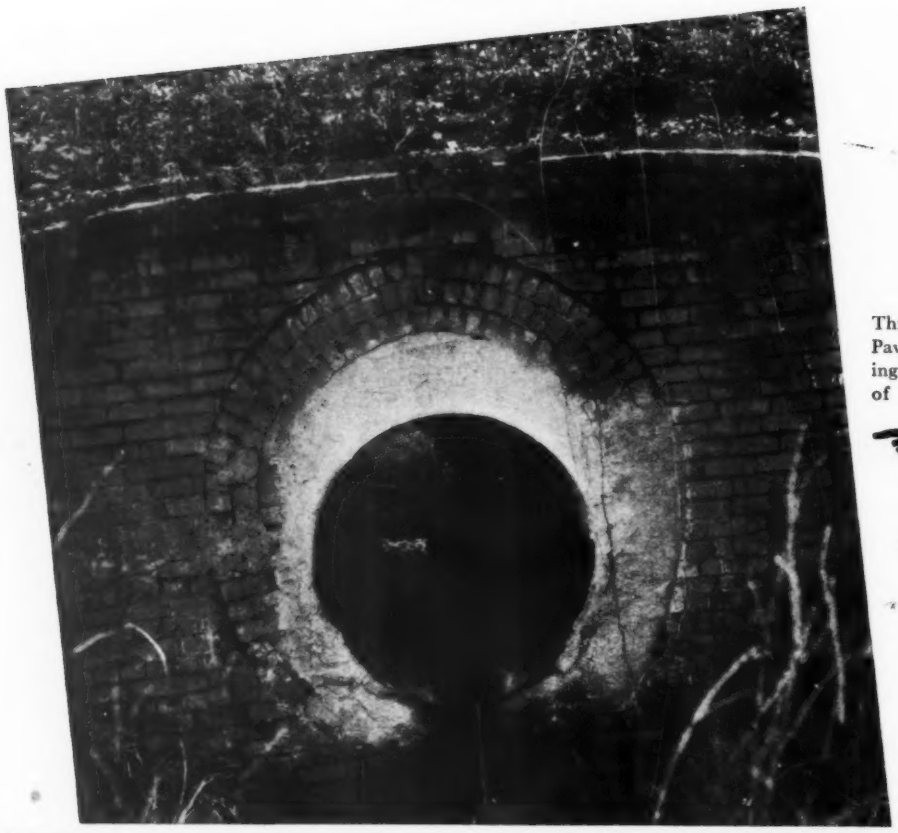
FOR MODERN STREAMLINED TRACK JACK PERFORMANCE AND EFFICIENCY

Right-hand lifting aids to railroad trackmen for more than 50 years, Duff-Norton Track Jacks of today are models of streamlined efficiency in modern design—in construction—and in performance.

Streamlined *performance* is assured by the famous genuine Barrett design . . . *safety* by the spring-actuated pawl and *long service* by the specially hardened steel wearing plate at the top of the base. Also the economy of interchangeable parts—all of which add years of faithful service to every Duff-Norton Track Jack.

Specify Duff-Norton Track Jacks and get the best.

THE DUFF-NORTON MANUFACTURING COMPANY *"The House That Jacks Built"* **PITTSBURGH, PA.**



Threading a 48-inch Armco Paved Pipe inside this failing structure saved expense of complete replacement.

AN EASY LOW-COST WAY To Replace Failing Culverts

The minute your maintenance crew discovers a weakened culvert, you'll be wise in replacing it *immediately*. The longer you wait, the greater the danger, and also the more it will cost for ultimate replacement.

By acting promptly, you can "thread" Armco pipe inside the failing structure without disturbing the roadbed or slowing down traffic. This way you save money, avoid delays and get a strong, permanent installation with little or no reduction in waterway area.

Many leading railroads prefer Asbestos Bonded Armco pipe because its structural design and ARMCO Ingot Iron base are proved by more than 30 years of continuous use. Besides, this pipe is "paved where the wear comes" and fully-coated with a special bituminous material that adds years of service because it's *inseparably bonded* to the pipe. Write for complete information. Ingot Iron Railway Products Co., Middletown, Ohio (Member of the Armco Culvert Manufacturers Association); Berkeley, California; Philadelphia, Dallas, Atlanta, Salt Lake City, Minneapolis, Los Angeles, St. Louis, Portland, Cleveland, Spokane, Chicago, Richmond, Houston, Denver.

ARMCO

Asbestos Bonded
ARMCO PAVED PIPE

A PRODUCT ORIGINATED AND DEVELOPED BY ARMCO ENGINEERS

GET RID

OF RAIL JOINT MAINTENANCE in CROSSINGS

Thermit welding equipment may be set up at a central location for welding rails into 200 to 300 ft. lengths. Such rails are readily transported for installation at crossings.

Upkeep of rail joints in grade crossings, with all its costly ripping up of pavement is one item of maintenance expense that you can get away from easily. Thermit Rail Welding is the answer.

Rails, Thermit welded into 200 to 300 foot lengths, can be installed in crossings at little cost, and, as far as joints are concerned, forgotten for the life of the rail; which, in itself, is lengthened appreciably. With no rail ends to batter, no angle bars to wear, no bolts to tighten; there is nothing to require attention. No reason to disturb the crossing pavement.

Light, compact and low in cost, Thermit welding equipment is as well suited to this type of work as it is to the welding of continuous stretches a mile or more in length. Equipment is readily mounted on cars and shipped from one point to another. Or, it can be installed at some centrally located yard and operated as a plant to turn out lengths of welded rail for shipment to required points. A comparatively small investment is involved, even when a complete welding outfit is furnished to each division.

Our nearest representative will be glad to go into the matter with you. Or, write for full particulars on Thermit Rail Welding, both for long continuous stretches, and for short lengths for use in crossings, stations and paved streets.

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N. Y.
ALBANY • CHICAGO • PITTSBURGH • SO. SAN FRANCISCO • TORONTO

THERMIT Rail WELDING

No. 118 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION
105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: A Mistake

October 1, 1938

Dear Reader:

Have you ever thought of the degree of accuracy that you expect from Railway Engineering and Maintenance? You accept errors in newspapers as inherent in publishing; yet you are surprised when your magazine, working in many ways under the same pressure to meet press schedules, makes an error.

We regard this contrast in attitude as a compliment to our papers. In fact, we greatly appreciate it, for it demonstrates a recognition on your part of the high standard of technical accuracy that we have, through years of service to you, caused you to expect of us.

An incident in the last issue illustrates this point. You noted the article therein by A. N. Williams. Mr. Williams is president of the Chicago & Western Indiana and the Belt railways of Chicago. In that article his title was given as president of the Chicago & Western Indiana and the Indiana Harbor Belt railways. The issue had scarcely left the presses when readers began to call this error to our attention by phone and letter.

It is not enough to offer in explanation that the two railways serve the same general function in the Chicago terminal area or that their names are similar, so far as the "Belt" is concerned. The fact is that the title was in error, that the error was made by our editors, and that it was not caught by those editors who check-read all copy.

This leads me to tell you of the precautions that we adopt as routine practice in handling all editorial "copy". In the first place, we have found it impractical to recruit members of our editorial staff from the newspapers because of their lack of appreciation of the necessity for complete accuracy in all details. Furthermore, it is our practice that all manuscript be check-read by a supervising editor to detect errors and confusing statements before it goes to the printer. After being set in type, all copy is then read again in galley form. Through these various measures we endeavor to maintain a high degree of accuracy in our pages.

While deploring this error, we are pleased nevertheless that in this unintentional manner we have found how many of you noted this error and went to the pains to call it to our attention. This demonstrates a thoroughness of readership of which we are proud. It demonstrates also your friendly interest in co-operating with us in maintaining these high standards. We appreciate this interest.

Yours sincerely,

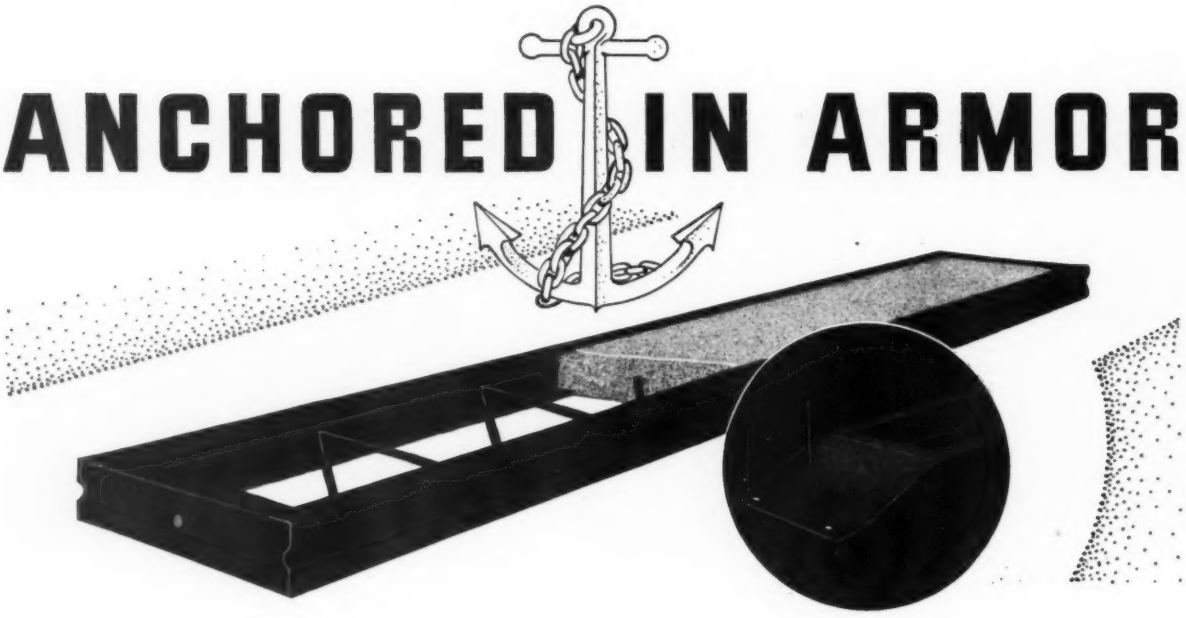
Elmer T. Howson

ETH:EW

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

ANCHORED IN ARMOR



● Concrete is *anchored into steel armor* in the construction of Truscon Weltrus Highway Crossings. The armor cannot loosen. Disintegration of concrete is prevented.

Made of rolled steel channels, Weltrus Crossing Sections have ribbed sides. Ends are completely closed with crown channels. Center reinforcing bar web, sides and ends are electrically welded into an integral unit.

Steel flanges overlap all corners, protecting the edges of the concrete. Sloping End Sections for bolting to the Weltrus Sections are available for protection to concrete and to prevent damage from dragging brake beams.

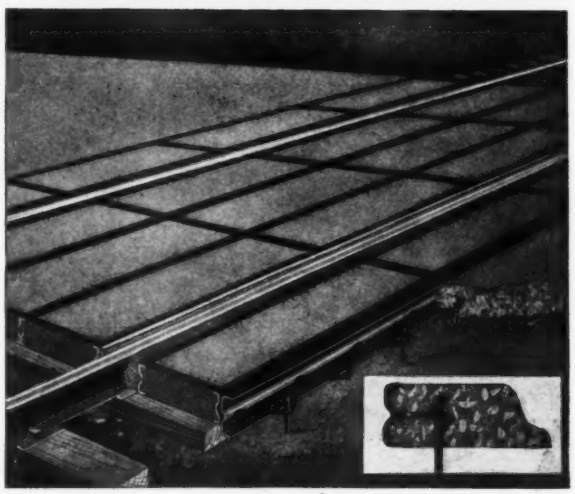
Dimensions of standard sections are 16¾"x 6 feet. Special sections can be furnished in any required width or length in heights of 4", 5", 6", 7" and 8". Standard width of planks between rails is 16¾". Where required, wider planks can be furnished for outer side of rails to fill space between rails and adjoining highway.

Installation of Weltrus Highway Crossings requires no special tools or sub-ties. Work can be done by regular section men. One or more sections can be removed when track work is necessary, thereby eliminating interference with highway traffic.

Write for free catalog which explains all details of Truscon Weltrus Highway Crossings, Intertracks Slabs, Header Sections and related equipment.

Truscon Weltrus Highway Crossing. Note center reinforcing bar web, sides and end channels (at left).
Detail showing Sloping End Section bolted to the Weltrus Section. Protects concrete. Prevents damage from dragging brake beams.

TRUSCON WELTRUS HIGHWAY CROSSINGS



Detail showing Truscon Weltrus highway header sections.

TRUSCON STEEL COMPANY

YOUNGSTOWN.... OHIO

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

OCTOBER, 1938

Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
1081 National Press Bldg.

SEATTLE
1038 Henry Bldg.

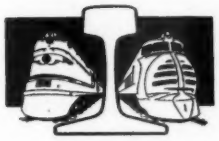
SAN FRANCISCO
485 California Street

LOS ANGELES
Union Bank Bldg.

Subscription price in the United States and Possessions, and Canada, 1 year $2, 2 years $3; foreign countries, 1 year $3; 2 years $5. Single copies, 35 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.).

Railway Engineering and Maintenance



Interest?

Whose Concern Is Railway Prosperity?

DO railway employees have a direct personal interest in the prosperity of the railways and especially of the railway for which they work? If so, should they endeavor to promote that interest? Or should they ignore the problems confronting the railways as of no concern to them? These questions will appear to many as idle conjecture for which the answers are self-evident. Yet the attitude and actions of large numbers of railway employees show that they fail to appreciate their significance.

Employment Declining

Take the question of employment. To every individual, security of employment is a vital consideration. Especially is this true of many classes of railway workers whose duties are so highly specialized as to fit them for few other occupations. When such a person is forced out of railway service, he must usually begin again at the bottom in a new industry.

In the period before the depression, the railways provided employment and a livelihood for approximately 1,750,000 persons. They now employ only 930,000 persons. In other words, more than 800,000 persons have been deprived of employment on the railways during the last 10 years. The reduction in employment within the last year exceeds a quarter million men.

Coming more specifically to maintenance of way, the normal pre-depression force approximated 450,000 persons—the force today is less than half that size. Thus, in this one department alone, nearly a quarter million employees have been forced to look elsewhere for support. Do these employees have an interest in the prosperity of the railways—a prosperity that means work for them and support for their families? And should the interest of those employees who are still on railway payrolls be any less direct in these days when entire lines are being abandoned and entire organizations broken up?

If employees have a personal, selfish interest in the prosperity of their industry, how can they be awakened to this interest? Means for the attainment of this objective rest in part with management, but more largely with the employees, through their relations one with another.

With an awakened body of employees, what activities can be undertaken? These activities fall into two categories—those involving direct action by employees among those with whom they deal and whom they choose to represent them—and a less direct but equally important campaign to acquaint the public with the facts regarding the railways, the indispensability of their services, the unfairness of the competition to which they are being subjected today, and the steps necessary to restore the roads to a fully solvent condition.

In the way of direct action, campaigns to promote patronage of those merchants who patronize the railways have brought traffic back to the railways in numerous centers and may well be extended. Equally helpful is individual appeal to state and national legislators when legislation helpful to the railways is under consideration.

Some Questions

Equally important is a public fully informed regarding railway problems and the measures necessary for their solution. Does the public believe that each transportation agency should be placed on a basis of equality with every other competing agency and be permitted to secure and handle business on the merit of its service?

If so, does it realize that while the railways neither solicit nor receive aid from public treasuries, every competitor of the railways, on the highways, on the waterways and in the air, receives large subsidies through the use of facilities built at public expense, either free of cost or by the payment of fees that repay merely a fraction of the outlay?

Does the public realize that while the railways provide their own rights of way and roadway and that these facilities represent more than 50 per cent of their total property investment, buses and trucks, barges and airplanes buy no rights of way, construct no roadways, bridges or culverts, and pay no taxes thereon?

Does it realize that whereas the railways spend an average of $2700 per mile of line per year for the maintenance of their roadways, their competitors bear no such expense but use facilities provided at public expense for which they pay ridiculously small rentals, if any at all?

Do the people realize how many children are afforded

the privilege of a public school education by reason of the taxes paid by the railways and that the railways contribute correspondingly to the other activities of government, whereas highway operators are clamoring for the allocation of all motor vehicle taxes and fees for the improvement of highway facilities, which will, if successful, place the entire burden of the support of government on other industries and taxpayers?

Do they realize the fundamental importance of an efficient network of railways to our national defense and the threat to this agency that is created by the diversion of traffic to other agencies, whose possible contribution to national defense in times of emergency is meagre?

Public Not Informed

That the public does not realize these inequities and others under which the railways are struggling is evidenced by the complacency with which it is viewing the situation. That this condition exists is surprising, for the public is more friendly to the railways today than for a generation. It needs to know the facts.

No one can disseminate these facts so effectively as the railway employee among his neighbors. Such activity reacts in a broad way to the benefit of the neighbor, for an efficient railway system is essential to a prosperous country. It reacts to the benefit of the railway industry, for the public can be trusted to act fairly in any matter in which it has the facts. It reacts even more to the benefit of the employee, for he cannot long prosper unless his industry likewise prospers.

The present situation creates an opportunity for the alert railway employee to promote his own prosperity. With this help, the railways will prosper and when they prosper, he will likewise.

Weeds—

An Increased Problem This Year

THE railways have enjoyed a bumper wheat crop this year, but, unfortunately, due largely to the same natural causes, they have also been faced with a bumper weed crop. Still more unfortunate, while farmers have been able to harvest their wheat, many roads have found it difficult to keep abreast of the necessary weed cutting. Thus, while there may be no immediate need for concern for the appearance of the right-of-way as the result of the more abundant growth this year, there need be real concern lest through failure to cut weeds before they have propagated themselves through widespread seed distribution, many railways will be confronted next year with still more abundant crop of undesirable growth.

Following spring and summer seasons with more than normal rainfall over large areas, many track maintenance men point today to weeds of greater height and in greater profusion than for a number of years past. Many of them have been confronted with insistent demands on the part of farmers that noxious weeds adjacent to their properties be cut. Many have been confronted with the demands of local and state authorities that increased attention be given to cutting noxious weeds generally, and to cutting any kind of growth on the railroad property which might interfere with visibility at street or highway crossings. At the same time, there have been an increased number of complaints on the part of trainmen that inability to keep down the weed growth in yards, and even along main and branch lines, has interfered with their work.

It is most unfortunate that the weed problem should arise so prominently this year when the railways are less able to give it the required attention. However, the fact remains that the unusual growth this year does present a problem and one that cannot be overlooked lightly, either in view of the current demands for its attention, or on the basis of forestalling a still more abundant growth in succeeding years.

Conventions—

Are They Worth While?

THE history of railway maintenance is one of constant change. As one looks back over the developments of more than a century, he can well be astonished by a comparison of the track and structures of the early years with those of today. It is both interesting and instructive to follow, step by step, the improvements and advances that have been made in materials and practices. One sees the slow progress from cast-iron rails, stone blocks, narrow roadbed, dirt track and flimsy bridges to the heavy steel rails, treated ties, clean ballast, well-drained roadbed and heavy bridges of today. He also learns of the chaotic conditions which characterized maintenance practices during the first half century of railway operation; of the lack of co-ordination of effort, even on individual roads; of the astonishing diversity in the design of materials and tools; and of the uneconomical practices of the period. An analysis of the record indicates clearly that these conditions were largely an outgrowth of the almost complete isolation of maintenance officers, from chief engineers to section foremen.

Today, in large part, materials and practices are standardized or are approaching standardization, so far as the diversified conditions of railway operation permit, and maintenance officers are no longer isolated. They learn of new developments quickly, are alert to adapt them to their own work, and are constantly adjusting themselves to new conditions with a flexibility that their predecessors would have found impossible. These changes are so marked that one immediately seeks the reason for them. While it will be found that many influences have been at work, it will also be discovered that they had their beginning with the organization of the Roadmasters Association, of the American Railway Bridge and Building Association and of the American Railway Engineering Association, and that these societies have been the most important influence in bringing them about. These organizations, one formed 56 years ago, another 8 years later and the third in 1900, have provided a forum for the exchange of ideas and experiences. They have thus enabled their members

to judge between the desirable and undesirable in maintenance practices, and have afforded an opportunity for the discussion of developments that are underway.

A study of the record will also show a strong contrast between the early meetings and those of today. Then, those who attended, because of long isolation, were somewhat intolerant of suggestions for improvements in their practices, for they were sure that their own methods were superior to any others and it was difficult to convince them to the contrary. Those who attend today are not only highly receptive and tolerant to such suggestions, but are quick to see how they can improve their practices.

The record also discloses that until recently the changes that did occur came slowly, generally through a process of natural evolution within the industry. Today, changes are occurring with a rapidity never before experienced, largely through influences without the industry, in which natural evolution plays only a small part. This situation requires constant readjustment of the point of view of operating and maintenance officers alike. Furthermore, the problems that are arising almost day by day are not problems that can be worked out by these officers individually; they require the best thought of many men and teamwork from all. This can best be secured from organizations such as those under discussion, and the maintenance officer who neglects to take advantage of the opportunity they afford to discuss the important problems now confronting him is doing an injustice to himself and to the company that employs him. Likewise, his superior who is unwilling for him to attend the conventions of these associations is doing an injustice to him as well as to his company.

Progressive and constructive as these groups have continued to be, they can never attain their full measure of helpfulness to the classes of men they aim to service, and through these men to the railways they represent, until those men directly interested in roadway, track and bridge and building matters, and the higher officers of their respective roads, contribute more generously toward the goal of maximum helpfulness toward which they are striving. This means increased interest on the part of a larger number of men, when most of these men feel that they are already overloaded with routine duties and obligations; it means increased participation in the work of committees; it means increased attendance at and participation in conventions; it means increased encouragement of the activities of these associations, and to its members, by the higher officers of the railways; and, in some instances, it means the acceptance of nominal expenses by both the men and their roads.

But, in the light of the past achievements of these associations, who will say that all of these factors are not more than justified in spite of present conditions? In fact, it is the present economic and resulting physical conditions of the railways, coupled with the increased demands being made upon the roadbed and structures, that warrant the increased interest in and encouragement of these associations called for. More and more, the duties of supervisory officers require careful planning, skillful organization of operations, efficient use of equipment, and intelligent dealings with their men. More than ever before, for the supervisory officer, it is a battle of wits against increasing problems.

The two associations meeting at this time of the year are geared specifically to fortify this officer in this battle. They have already been the finishing schools for hundreds of men charged with the responsibility of maintaining the tracks and structures of the railways, and hold forth to render still increased service to maintenance of way men and their respective roads as there becomes a fuller appreciation that it is during times such as those through which we are now passing, that associations such as these can be most helpful.

Line—

More Important Today Than Ever Before

WHILE good line has been a subject for discussion through many decades, it has assumed greater importance during the last four years than at any previous time. Although good line has always been recognized as an essential for good riding track, the initiation of high-speed schedules has brought an entirely new view point, not only with respect to its importance, but also with respect to the refinements that are necessary and the need for giving attention to small defects as soon as they appear, to prevent them from growing.

Knowledge that the maintenance of line is intimately associated with the maintenance of surface, including cross level, is not of recent origin; yet this fact has also assumed greater importance than ever before in connection with high speeds. Irregular line causes a lurching movement and side swings that are not only uncomfortable but may cause apprehension, and in the higher range of speeds may become unsafe.

Continued lateral stresses and blows tend to loosen the spikes and spread the track, even where heavy tie plates are in service. With small or light tie plates the rails also tend to tip. Any irregularity in the line that is not corrected grows progressively worse with the passage of every train, particularly as the initial lateral movement does not subside at once, but continues some distance from the original irregularity, thus extending the defect. The effect of these lateral blows does not stop with the spikes and tie plates, but tends to shift the ties laterally on their beds, thus affecting the surface which soon begins to show defects.

At low speeds, irregularities in line can be of considerable magnitude without seriously affecting the comfort of passengers, the safety of the train or the surface of the track. As the speed increases, discomfort increases and becomes apprehension, the margin of safety disappears and the effect on surface becomes of considerable magnitude. It should be borne in mind that at high speed the line does not have to be grossly irregular to produce these effects, for even slight irregularities will do so. This indicates the importance of correcting small defects as soon as they become apparent. The fact that the program of the present convention of the Roadmasters Association includes a committee report on The Maintenance of Line and Surface To Meet Present Day Operating Requirements is ample evidence that maintenance officers are thinking of the matter in the light of changing conditions and not from an academic point of view.

Preframed Transfer Bridges

The Baltimore & Ohio, an early exponent of treated timber for crossties and railway structures, and also of the framing of all such timber before treatment, has recently completed the last of four preframed treated transfer bridges which it has built since 1928, all of which are expected to have a long service life with little or no maintenance. This article describes the last of these bridges, and the manner in which it was erected four miles from the point of its installation and then floated to position on a car float and its own pontoon.

THE Baltimore & Ohio, with its large waterfront properties along the eastern seaboard, has had considerable experience in the construction of car transfer bridges and has recently completed the last of four such structures, all of preframed, creosoted timber, which it expects will continue in service, with little or no maintenance, for upward of 40 years. Of special interest in this connection is the fact that the last of these bridges was erected approximately four miles away from the point of its installation to avoid interference with the use of existing facilities, and was floated to and set in working position within approximately 12 hours' actual working time.

The first two of these preframed treated transfer bridges were built at St. George, Staten Island, New York, in 1929; the third was built at Pier 62 South, Delaware river, Philadelphia, Pa.; while the last was erected at Pier 63 South, Delaware river, Philadelphia, and was floated as a unit to Pier 40 North, where it replaced an untreated structure which had so deteriorated in 23 years of service that it required renewal. All four of the structures are of the same size and design, and all were preframed and treated at the road's large preframing and treating plant at Green Spring, W. Va. This article will deal largely with the last of the structures to be built, and with the manner in which it was erected and placed in position.

Details of Bridge

All of the bridges carry two tracks, are approximately 100 ft. long, and are made up essentially of three Howe trusses supporting a suspended-type timber deck. In the consist of the trusses, which are spaced 16 ft. 9 in. center to center, the lower chord is made up of four lines of 8-in. by 16-in. timbers, while the upper chord is made up of four lines of 6-in. by 16-in. timbers. The timbers in both chords are set on edge, in ply arrangement and separated by 1½-in. spools, and are bolted together to form continuous, monolithic members. In these members also, the ends of the timbers are accurately butted, and all joints are staggered with adjacent joints and are spliced with ½-in. steel plates. Furthermore, each chord as a whole has a camber of 4 in., a feature which had to be taken into consideration in the framing of each member of the trusses to insure perfect, full-bearing connections.

The diagonal web members of the trusses consist of timbers from 6 in. by 8 in. to 10 in. by 10 in. in size, used either single or double, and all of them have bearing at both top and bottom on heavy batter-faced, heel block castings. Each truss as a whole is tied together at each upper and lower-chord panel point, and at the end posts, by means of steel hanger rods ranging in diameter from 1¼-in. to 2½-in., with heavy steel bearing plates and take-up nuts both beneath the lower chord and on top of the upper chord.

The deck system consists essentially of 12-in. by 16-in. floor beams spaced generally from 2-ft. to 2-ft. 6-in. center to center, except over the pontoon where the spacing was widened out to as much as 3-ft. 4-in. Each floor beam is secured to the lower chord of each truss by means of two 1¼-in. bolts, equipped with

The Pontoon End of the Bridge, Showing the Elevation Control Pump House at the Left, and the Car Float Mooring Winch at the Extreme End

on the B. & O.

Approximately 70,000 Cu. Ft. of Preframed Treated Timber Entered Into the Construction of the Bridge

1-in. steel bearing plates both top and bottom. The deck track rails, of 100-lb. section, rest on ½-in. tie plates, which are supported directly on the floor beams. Between and outside the rails, the deck is covered with 2-in. by 10-in. treated plank, with open joints.

Pontoon

The latest preframed transfer bridge employs a pumping-type pontoon to support its outer end, while its inshore end is provided with steel-faced rocker logs which set in steel-lined rocker blocks. The pontoon is essentially a treated timber box, 45-ft. long by 40-ft. wide, and 10-ft. deep, which is divided into six compartments, two along each side, and two longitudinally through the center. Of the six compartments, all of which are carefully calked and waterproofed, the four outside compartments are air chambers, designed to give the pontoon a fixed buoyancy, while the two inner compartments are air and water chambers, by means of which the buoyancy of the pontoon as a whole can be increased or decreased, thereby raising or lowering the outer end of the bridge as necessary to meet the deck level of car floats under any condition of loading.

Flooding of the two water compartments is effected by two hand-operated sea valves, at opposite ends of the pontoon, while dewatering is done by means of a motor-operated centrifugal pump housed within the side limits of the center truss, near the center of the pontoon longitudinally, which takes water from both compartments simultaneously. Complete flooding or dewatering of the pontoon requires from six to eight minutes, but since adjustment of the level of the bridge can be and ordinarily is made approximately correct prior to the docking of a car float, the actual time required for adjustment during docking is seldom more than two or three minutes.

From shop drawings of the various members of the bridge, which showed the details of all cuts and borings, each member in the structure was completely framed in advance of treatment. The timber throughout is long-leaf yellow pine, with the exception of the rocker logs and rocker blocks, the head floor timbers, and the face sheathing of the pontoon, all of which are white oak. All cutting and boring was done with power tools or machines, and so precise was the work and so great was the confidence in its accuracy, that no attempt was made to test-assemble the structure before treatment. However, all of the upper and lower chords of the trusses were completely assembled after framing and were treated as assembled units, three of them undergoing treatment in a cylinder at the same time. The full-cell process, employing straight No. 1 creosote oil, and carried out in accordance with the specifications of the American Wood-Preservers' Association, was used in the treatment of all timber in the bridge. This treatment was continued to a retention of 10- to 12-lb. of oil per cubic foot for all timber, except the white oak, where it was difficult to secure this retention, and in the case of the submerged pontoon timber, where a retention of 8-lb. per cubic foot was considered sufficient. Because of the desire for early completion of the bridge, the timber was loaded on cars shortly after treatment, and shipped promptly to the site of erection at Philadelphia, the long chord members extending over three cars.

The site chosen for the erection of the bridge was at Pier 63 South, which had formerly been the site of a car transfer bridge, but which was now free of the old bridge and of all tracks or other structures directly back of the old bulkhead. This location, adjacent to Pier 62, which is still in service, and to other Baltimore & Ohio facilities in this same general area, provided not only the necessary working area for erecting the bridge, but also adequate slip area and depth for launching it when completed.

In addition, a group of three old-pile bents immediately ahead of and parallel with the bulkhead proved advantageous in the launching operations. These old bents, which were located close together and within 12-ft. of the face of the bulkhead, and capped at about high-tide level, had formerly supported the rocker blocks of the old transfer bridge in this location. Another advantageous feature of this location for erecting the new bridge was that it was closely paralleled on both sides by existing tracks, which made it possible to use locomotive cranes for handling the timbers during erection, and as the pulling force in the launching work.

Rail Skidways

To permit the launching of the bridge in the position most advantageous for the floating operations and for later hinging it in its final position, the bridge was erected longitudinally at right angles to the face of the bulk-head on a skidway consisting of three lines of 130-lb. rails. The water or pontoon end was located approximately over the bulkhead, so that during erection the entire structure was clear of the water.

In the skidway arrangement, the three lines of rails were leveled up on timber cribbing or blocking as

necessary, at an elevation just clearing the top of the bulkhead, and were so spaced that the two outer lines lay just beneath the outer faces of the outside trusses, while the third line lay immediately to one side of the center truss. The purpose of this arrangement of the rails was to permit ready access to the undersides of the lower chords of the trusses for such assembly work as was necessary, while at the same time distributing the load of the bridge to the three rails as uniformly as possible. To carry out the plan of launching, the skidway was extended beyond the face of the bulkhead and was cribbed up on the old rocker block bents of the earlier transfer bridge.

Method of Erection

With the skidway completed, the first step in the erection of the new bridge was to set all of the floor beams in proper position on the skid rails. This was followed by laying down the pre-assembled lower chords of the three trusses and bolting them to the individual floor beams. When this had been done, the designed camber was provided in the lower chords by placing blocking of the proper thickness between the skid rails and the bottom of each seventh or eighth floor beam, this blocking including a 1-in. steel plate on the bottom to act as a slide plate during the launching operations.

Each truss was erected separately, the first step after the setting of the lower chord being to raise the upper chord directly above the lower chord, and to block it slightly above its final elevation on a series of two-post falsework bents at right angles to and straddling the lower chord. When secured in this position, the timber and rod web members of the truss were set in place, working continuously from one end toward the other and lowering the upper chord to its final position as the work progressed. Working in this manner and employing two bridge gangs with a total of 16 men, and two locomotive cranes on adjacent tracks for the handling of all of the various bridge members and heavy heel blocks and steel connection plates, the three trusses were completed one at a time, the entire structure being assembled and ready for launching in a period of approximately three weeks.

Launching

The launching of the bridge involved pulling it forward over the well-greased skid rails, and floating it, for towing to its final location at Pier 40, on the rear end of a car float and its own pontoon. The sliding of the bridge was effected by means of a 3 to 1 block arrangement on each side, employing 1¾-in. manila rope taken in by the winch of a locomotive crane on one of the parallel side tracks, and by the winch of the wrecking crane on the opposite side track. Working together, taking in on their winches and backing up as necessary, the two cranes moved the bridge forward in successive stages, as desired, without difficulty.

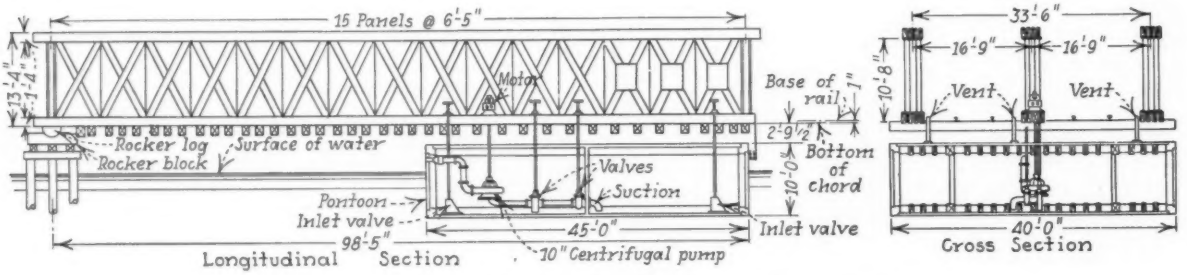
The first move of the bridge was for a distance of about 13-ft., to bring its water end out to the end of the skid rails, directly over the old rocker block bents immediately ahead of the bulkhead. The new pontoon had previously been backed up to these bents and securely lashed to them, and three lines of temporary skid rails had been placed on its deck and lined up with the skid rails on which the bridge had been constructed.

When the forward end of the bridge had reached a position over the old rocker block bents, the move was continued out over the pontoon and its skid rails, which were at an elevation slightly lower than that of the fixed skidway. As the bridge was moved forward, the slide plates beneath its deck gradually contacted the rails on the pontoon, and as this took place, the pontoon assumed an increasing proportion of the load.

The launching operation was continued in this way until the front end of the bridge extended slightly beyond the front of the pontoon. When this position had been reached, a car float, which had previously been counter-weighted at its front end by heavily loaded coal cars, was backed up to the pontoon, and then the forward movement of the bridge was resumed. When the bridge had been moved to the point where approximately 12-ft. of its front end extended over the car float, blocking was placed between the bridge and the deck of the float in order that the float would take up the load of the bridge as it was moved progressively forward. At the point of blocking, the bridge was lashed securely to the float.

When this had been accomplished, the chain by which the pontoon had been secured to the old rocker block bents were removed, permitting the free movement of the pontoon, and the launching operation was continued, pushing the car float and the pontoon ahead until the rear end of the bridge rested near the end of the skidway. When this position had been reached, and with the ebbing of the tide, sufficient water was permitted to enter the pontoon to sink it to a point entirely free of the bridge. The skid rails on the pontoon deck were then removed, and the pontoon was shifted back to a point nearly midway the length of the span. Here, it was dewatered by means of a pump provided on the span for this purpose, until it rose and again made contact with the underside of the bridge. Then, with the normal rise of the tide, a total of approximately 5½-ft., the pontoon assumed the load of the inshore end of the bridge, freeing it from the skidway, ready to be moved out and to be towed to Pier 40, North.

The entire launching operation required less than a day, and if it had not been for exceptionally rough water at the time the launching was completed, the bridge would have



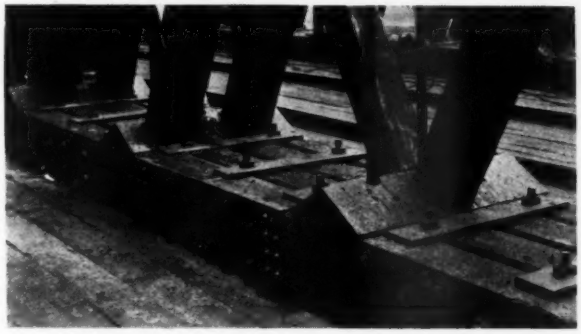
Sketches Showing General Features of the Transfer Bridge and Its Pontoon

been moved up the river the same night. However, the towing operations were delayed until the following day, when, with the aid of the steam tug, the four-mile move to Pier 40 was made in about two hours.

Installation

At Pier 40, everything was in readiness to receive the new bridge, the old bridge having been dismantled and removed during the two previous days. The actual seating of the new bridge was relatively simple although it required a number of detailed operations before it was entirely completed. First, while still lashed to and, in part, supported by the car float, the bridge was backed into its proper final working position, and then, with the lowering of the tide and some flooding of the pontoon, the new rocker logs of the bridge were seated directly within the new rocker blocks which had been provided upon the removal of the old bridge. With this operation completed, the pontoon was freed from the bridge by flooding it, and, with the ebbing of the tide, it was moved as far forward as possible toward its final position at the outer end of the bridge. Here, it was again dewatered until it rose and assumed the weight of the end, freeing the car float of any load.

The next operation was to move the car float just clear of the end of the bridge and to set up an arrangement whereby, in this position, it could again be made to assume the load temporarily without interfering with the moving of the pontoon forward to its final position. The arrangement devised for this operation consisted of booming out from the end of the bridge at the floor level with 12-in. by 12-in. horizontal timbers, and giving the ends of these boom timbers support on the car float. The boom timbers were laid directly upon the deck floor beams, and were each strutted to a rigidly-fixed position by means of vertical posts wedged tightly between them and continuous transverse header timbers having upward bearing against the underfaces of the top chords of the three trusses. Through this arrangement, the load of the outer end of the bridge was again picked up by the car float, freeing the pontoon and making it possible to move it forward to its final position without obstruction. All of these operations, from the seating of the rocker logs to the final anchoring of the pontoon, were completed the same day, leaving only minor finishing operations, including the laying of the track rails and the deck plank, before the bridge could be put in service.



A Close-Up View of One of the Lower Chord Splices, Showing Several of the Heavy Heel Block Castings

No Field Framing Necessary

The new bridge involves approximately 70,000 cu. ft. of treated timber and about 200,000-lb. of iron and steel in its heel block castings, connection plates and truss hanger rods. No attempt was made for any record in either its erection or installation, but rather to insure accurate framing, thorough treatment, and erection and installation with the most efficient use of labor and equipment. In this connection, it is of interest to note that the pre-framing was done with such accuracy that the entire structure was erected without the necessity for making a single cut or hole in the field. Furthermore, each operation of erection and installation was carried out exactly as planned, entirely by company forces, without accident or special difficulty.

The plans for the new bridge were prepared under the direction of H. A. Lane, chief engineer, and P. G. Lang, Jr., engineer of bridges, while the erection and installation work were carried out under the general direction of P. Petri, chief engineer maintenance, and under the immediate supervision of W. Morrow, division engineer.

How Handle Acetylene Cylinders?*

SPEAKING at a recent regional meeting of the Safety section, A.A.R., at Chicago, E. J. League, of the bureau of explosives, said that "Last week I saw a gang unloading gas cylinders along the right of way. They were dumping them unceremoniously out of a box car. What would have happened if one of them had hit a tie, a rail, a rock or some other hard substance, or even if it had landed on hard ground? It is on record that an *empty* oxygen cylinder that toppled over onto the concrete floor of a freight house, exploded, killing one man and injuring another.

"I do not know whether any gas cylinders have ever exploded while they were being unloaded from work trains, but a potential explosion is present every time one is dumped in this manner. Three weeks ago I was in a gas manufacturing plant, and at every turn I saw signs warning the employees not to drop cylinders or handle them roughly. If those who manufacture the gas treat it with such great respect, why should we not do the same?

"Acetylene cylinders contain not only acetylene, but are filled with a porous material which is saturated with an inflammable liquid—acetone. Acetone absorbs acetylene gas; otherwise it would be impossible to transport it with any degree of safety.

"I have seen men out on the job disconnect an acetylene cylinder because it was empty, or nearly so. I have seen them leave the outlet valve open to insure that it emptied itself of the acetylene gas. Sometimes they have forgotten to close the valve after the acetylene was exhausted, allowing the acetone itself to vaporize and escape through the open valve.

"We had a case where a gang was loading a lot of these so-called empty cylinders into a box car, to return them to the manufacturer for refilling. As the men returned from lunch some of them were smoking, taking the last puff at their cigarettes as they entered the car. When the lighted cigarettes were introduced into the acetone vapor that had collected in the car during their short absence, there was a severe explosion, killing those that had already entered the car."

*From the Monthly News Letter of the Steam Railroad group of the National Safety Council.

Bridge Work at High Levels Presents Serious Scaffold Problems

Wood Scaffolds—

How to Make Them Safe

THE principal causes of scaffold accidents are poor or defective material; scaffolds improperly and inadequately built; use of a lightly constructed scaffold to support heavy equipment and material; use of scaffolding for purposes other than that for which it was built; lack of a substantial base or foundation for the pole type of scaffold; lack of adequate diagonal bracing, which should be in the form of a triangle, and failure to use a sufficient number of nails—or nails of sufficient length—at joints. Generally accepted practice demands a minimum of five nails per joint.

This Scaffold Violates Several Desirable Safety Practices

General rules which should be observed in the building of scaffolds and in their use include the following: Materials should be the best obtainable; safe means of access should be provided (these should consist of stairways, permanent ladder, or portable ladders); the available working space should be sufficient to permit workmen to move freely and safely about their work; there should be sufficient headroom; exposed edges should be guarded by standard railings and toeboards, and in some cases, wire mesh in addition to keep materials from falling off the scaffolds.

All scaffolds should be substantially built and securely braced, and provide an ample factor of safety under full load; they should be capable of sustaining a load three times the combined weight of the men and materials which may be placed upon them. All of the load-bearing metal parts should be of high grade iron or steel; cast iron is not recommended.

Scaffold planks may fail because of: (a) Wrong species or grade of wood; (b) Insufficient size; (c) Overloading; and (d) Not being properly secured to the scaffold supports.

All scaffold planks should be carefully selected; they should be dry, well seasoned, straight and close grained; they should be free from injurious ring shakes, checks, splits, cross grains, unsound knots, knots in groups, decay, or growth characteristics that materially decrease the strength of the planks.

Should Not Overload

Scaffold planks should not be subjected to overloads. Table 1 gives the safe loads for scaffold planks. To test a scaffold plank, block it up a foot from the ground, placing the supports the same distance apart as the scaffold supports on which it is to be used, and load it with three times the load it will be required to support in actual use, placing the load as close to the center as possible. At the slightest sign of weakness, discard the plank.

Scaffold planks should be laid flat with an overlap of about 18 in. over the support, with no openings between the ends of planks; when planks 2 in. by 10 or narrower are used, not less than two, and preferably three or more planks should be used. When two or more planks are used, they should be tied together by cross strips securely fastened to the underside of the planks at the center of the span. The length of the cross strips should be equal to the combined width of the planks. All planks used on any one scaffold

Much work about bridges and buildings requires scaffolds. The failure of any part of a scaffold may cause a serious or fatal accident. It is important, therefore, that those using scaffolds know how to construct and use them. This article, an abstract of rules formulated and published by the National Safety Council, Chicago, gives a practical working code for the use of scaffolds.

should be of uniform thickness, and the scaffold should be constructed so that no nails will be subject to direct pull. For material approximately ¾-in. thick, cut steel nails should not be less than 8d; for 1¾-in. material, not less than 16d; and for the other lumber sizes in proportion.

A substantial railing and toeboard are necessary on all open sides of scaffolds 10 ft. or more above the ground. The railings should be not less than 34 in. high (42 in. is preferable) and should be constructed of 1⅝ in. by 3⅝ in. lumber, with posts every 8 ft. Where the lower edge of the railing is more than 34 in. above the scaffold floor, an intermediate rail of not less than 1-in. by 6-in. lumber should be provided. Toeboards should be solid and not less than 5½ in. high except on swinging or suspended scaffolds.

Pole Scaffolds

Important points in the design, construction and use of the pole type of built-up scaffold are:

(a) The uprights or poles should rest on a solid foundation.

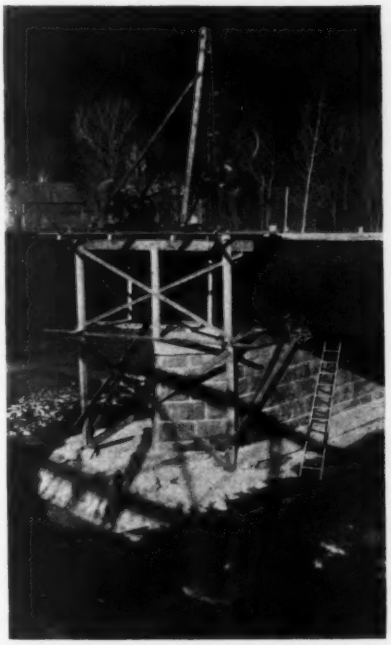
(b) Uprights should be plumb and fixed at the bottom.

(c) Uprights for scaffolds not exceeding 50 ft. in height should be 4 in. by 4 in. with squared ends and with members resting directly on each other. Cleats, not less than 4 ft. long, should be nailed on two adjacent sides of uprights at the joints. Joints should be staggered every second upright. In cases where the scaffold is to be used by painters and no appreciable dead load is imposed, uprights may be 3 in. by 4 in.

(d) Ledgers, not less than 2 in. by 6 in., should be well nailed to the upright, preferably on the inside. It is recommended that five 10d cut steel nails be used at each nailing point.

(e) Crossbars or bearers to carry the platform should be not less than 2 in. by 8 in. or 4 in. by 4 in., and a minimum of five cut steel nails should be used at all nailing points. These members should always rest on top of the ledgers.

(f) Longitudinal bracing of poled scaffolds for general use provides a brace of 1-in. by 6-in. at a 45 deg. angle from every alternate post in one direction, and at in-between posts a similar brace extending in the opposite direction. Braces should run from post to post with no splices between and should be nailed to each post with at least four 10d cut steel nails placed on the outer surface of the upright. Longitudinal bracing on inside poles may be eliminated at work levels in some cases, but should be installed below working levels as scaffolds increase in height.



Even Some of the Most Simple Appearing Scaffolds Must Be Carefully Designed to Avoid Unsafe Conditions

(g) Transverse bracing should be used between each set of poles, installed in one direction so that it will not interfere with the passage of workmen; 1-in. by 6-in. boards, with four or five 10d cut steel nails should be used.

(h) When window braces are used, the window frame should be securely anchored in place. It may be better to let the brace pass through the window opening and be secured to the floor. Scaffold structures should be secured to the building at every possible point, fastening braces to the ledgers close to the pole or, when possible, to the poles themselves.

(i) Platforms should be at least 4 ft. wide between uprights. Not less than 2-in. by 10-in. planks should be used, and these should be laid tightly together. A space of 4 to 8 in. should be left between the wall and the inside plank.

Swing scaffolds, with platforms of the ladder type, should be constructed of first class material. The

TABLE 1—SAFE CENTER LOADS FOR SCAFFOLD PLANK
(Select Common Eastern Spruce, Select Common Norway Pine and Select Structural Eastern Hemlock)

Span in Feet	Size of Plank in Inches					
	2x8 Dressed to 1⅝x7½	2x10 Dressed to 1⅝x9½	2x12 Dressed to 1⅝x11½	3x8 Dressed to 2⅝x7½	3x10 Dressed to 2⅝x9½	3x12 Dressed to 2⅝x11½
6	202	256	309	526	667	807
8	151	192	232	395	500	605
10	121	153	186	316	400	484
12	101	128	155	263	333	404
14		110	133	225	286	346
16			116	197	250	303

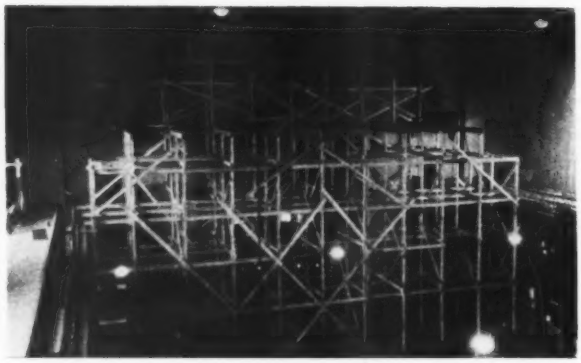
Above values are for planks supported at the ends, wide side of plank face up, and with loads concentrated at the center of the span.

For loads uniformly distributed on the wide surface throughout the length, the safe loads may be twice those given in the table.

Loads given are net, and do not include the weight of the plank.

If select structural Coast Region Douglas Fir, merchantable structural longleaf Southern pine or dense structural square edge and sound Southern pine are used, above loads may be increased 45 per cent.

sides of the ladders should be made of clear spruce or material of equivalent strength and rungs should be made of straight-grained oak, ash or hickory with a minimum diameter of ⅞ in. at the mortised ends. Iron rods should pass through the sides and be riveted over washers at both ends. Floor strips should be not more than ⅝ in. apart, and the flooring should be at least ½ in. by 3 in. in size. The hangers should be not more than 22 ft. apart, of either iron or steel, of one continuous piece, passing underneath the platform with attachments for railing and toeboard. Every swing scaffold should be lashed to some stationary object to prevent the scaffold from swaying.



Complicated Scaffolds Like This Require Careful Design to Insure Safety and Economy of Construction

Probably the most important feature of a swing scaffold is to see that it is properly and securely hung from the eaves, cornice or other reliable support, with hooks of adequate strength and properly placed. All available anchorages should be carefully inspected before the hooks and hangers are placed. The ropes should be of the best grade of manila, not less than ¾ in. in diameter, on at least 6-in. blocks; steel cable should be not less than ¼ in. in diameter. Steel cable used for swing scaffolds is wound on a drum, and not pulled by hand.

It is dangerous to hang a scaffold from planks which are cantilevered from the roof. If a cantilever support must be used, timber of substantial size is needed, with at least five-sixths of its length resting upon the roof and the inner end securely tied to the roof framing or weighted down with heavy planks nailed or lashed to the timber.

Suspended scaffolds should be well supported. Outriggers should be well secured to the frame of the building by clamps or U-bolts and should be equal in strength to 6-in. I-beams. There should be no question about the fit of the nuts over the threads of bolts. The shackles or beam clamps holding the cable should be well fastened to the outriggers with a stop bolt in the outer end of each outrigger. Steel cables only should be used, and they should be securely fastened to both the outriggers and the putlogs which carry the platform or to the hoisting machines, as the case may be. Only experienced men should operate the hoisting machines or winches to raise or lower the scaffold, and great care should be used to keep the scaffold level.

The putlogs should be not more than 10 ft. apart, and of not less than 4-in. by 5-in. timbers or equivalent. The platform itself should be not less than 4 ft. wide, of 2-in. planks properly secured and laid close. The outside of the platform should be provided with substantial iron or wooden railing not less than 42 in. high and a solid toeboard not less than 6 in. high. The space between the toeboard and railing should be filled in with wire netting of not more than ¾-in. mesh.

Iron Workers' Scaffolds

Iron workers' (needle beam) scaffolds should consist of planks at least 2 in. by 10 in. for 10 ft. span, with cleats or drop bolts to prevent slipping. At least two planks are necessary. If the distance between supports is 12 ft., beams should be of at least 4-in. by 6-in. timber or 3½-in. wrought iron or steel pipe; if 12 to 16 ft. of 6-in. by 6-in. timber or 4-in. pipe. The rope should be at least 1 in. in diameter for a small scaffold, and larger in proportion to the load. Drop bolts should be ⅝ in. in size and at least 6 in. from the ends of the plank. The ropes should be attached to the beams by a scaffold hitch and should be attached at least 1 ft. from the end of the beam. Ropes should be watched carefully to insure that they are in good condition and free from injury. Pads should be placed over sharp corners of beams to prevent wearing the rope.

Miscellaneous

Outrigger scaffolds for cornice and other light work are not favored if another type of scaffold can be used. The outriggers should project through the wall or through windows and be solidly supported and braced inside the building. External braces should be provided wherever possible. When supporting a built-up scaffold, outriggers should be carefully designed and constructed to carry the load.

Horse scaffolds should be substantially constructed, and it is very important that horses be located so that they are stable. Horse scaffolds more than two tiers high should be braced to windows; each horse should be well nailed to the planks both above and below, and the horses placed directly over one another. This type of scaffold should not exceed three tiers or a total height of 15 ft. In miscellaneous types of built-up scaffolds, such as roof brackets, roof scantling and crawling boards, it is important that each be of substantial construction and securely fastened in place.

In cases where scaffolding of any kind cannot be used or cannot be depended upon, a life belt and life line should always be used and securely fastened.

TABLE 2—COLUMNS

	Height in Feet					
Size of Post in Inches	4	6	8	10	12	
2x4 (1⅝x3⅝)	3194	1695	126	.....	.....	.....
2x6 (1⅝x5⅝)	5032	2663	198	.....	.....	.....
4x4 (3⅝x3⅝)	.....	9669	7956	6299	4620	.....
4x6 (3⅝x5⅝)	.....	15195	12513	9899	7261	4605

Safe load in pounds for timber columns with square bearing and symmetrical loads. Table is for Douglas Fir, Sound Yellow Pine, and Western Hemlock, based on the formula $S = 1200\left(1-\frac{L}{60D}\right)$ Calculations are for free standing columns.

L = Effective length of column in inches.
D = Least side or dimension of column in inches.

Roadmasters Set New Record at Convention

The fifty-third annual convention of the Roadmasters and Maintenance of Way Association was characterized by a record attendance for the depression years and by a highly constructive program which included six reports and five addresses by railway officers, on current problems. An effective exhibit of materials and equipment presented by the Track Supply Association added to the value of the meeting. The entire program of the convention, with the exception of two addresses which will be published in subsequent issues, is presented on the following pages.

Recognizing its possibilities for increased helpfulness during these days of stress through which the railways are passing, and accepting responsibility for increasing its service to the railways, the Roadmasters and Maintenance of Way Association held one of the most successful conventions in its fifty-three years of activities, at the Hotel Stevens in Chicago on September 20-22. The meeting, which was supplemented by an exhibition of maintenance of way materials and equipment, presented by the Track Supply Association, was attended by more than 350 railway officers, with a total attendance, including exhibitors, of more than 700.

The program, which was one of the most constructive in the history of the association, and adapted especially to meeting the problems confronting maintenance of way men today, included reports by committees on The Materials and Equipment for the Section Gang of Today; The Maintenance of Line and Surface to Meet Present Day Operating Requirements; The Elimination of Train Derailments Resulting from Track Defects; The Maintenance of Turnouts; The Programming of Track Work; and Methods of Instructing Track Men in Safety. In addition, the convention was addressed by Fred G. Gurley, assistant vice-president, Chicago, Burlington & Quincy, on The Roadmaster's Job; by F. R. Layng, chief engineer, Bessemer & Lake Erie, on Better Track Construction for Tomorrow's Traffic; and by F. S. Schwinn, chairman, Committee on Economics of Railway Labor, A.R.E.A., and assistant chief engineer, Missouri Pacific, on Using Track Labor Efficiently. Abstracts of these addresses, with the exception of that of Mr. Layng, which will be published in a subsequent issue, appear on following pages, together with the convention reports in full, and the discussions which followed.

A high point of the convention was a luncheon on Wednesday noon, where more than 200 members and guests were addressed by W. K. Wallace, chief engineer of the London, Midland & Scottish railway of England, on American and European Maintenance Practices. Mr. Wallace's comments will be presented in a subsequent issue. Other features of the meeting included a banquet on Wednesday night, tendered to members of the association and their families by the Track Supply Association, which was attended by 550 persons; an evening of motion pictures on Tuesday, featuring the United States Steel Corporation's technicolor film showing the manufacture of steel; and a Question Box session on Wednesday, at which were discussed practical questions on track maintenance submitted from the floor. Still another feature of the program was a visit to the plant of the Pettibone Mulliken Corporation on Thursday afternoon, where members were given an opportunity to observe the construction of special track materials. All of the five sessions of the convention were presided over by W. O. Frame, assistant superintendent on the Chiacgo, Burlington & Quincy, and president of the association.

In the election of officers at the final session of the convention on Thursday, A. H. Peterson, managing editor, Railway Engineering and Maintenance Cyclopedia, Chicago,

was advanced from first vice-president to president; F. B. La Fleur, roadmaster, Southern Pacific, Lafayette, La., from second vice-president to first vice-president; G. L. Sitton, chief engineer maintenance of way and structures, Southern, at Charlotte, N.C., and a director of the association, was elected second vice-president; and C. A. Lichty, Chicago, and E. E. Crowley, roadmaster, Delaware & Hudson, Albany, N.Y., were re-elected, respectively, secretary and treasurer. Four new directors were elected,—A. B. Hillman, roadmaster, Belt Railway of Chicago, to fill the unexpired term of G. L. Sitton; J. J. Clutz, supervisor, Pennsylvania, Trenton, N.J., to fill the unexpired term of W. S. Lacher, who resigned during the year upon becoming secretary of the American Railway Engineering Association; and R. S. Kniffen, general roadmaster, Great Northern, Duluth, Minn., and F. J. Liston, roadmaster, Canadian Pacific, Montreal, Que.

The report of the secretary showed more than 500 members of the association in good standing, and that 90 new members had been taken in during the year, while the report of the treasurer showed an excess of receipts over disbursements of more than $200. Chicago was selected as the headquarters for the next convention.

The following subjects were selected for study by committees during the next year: Specialized Versus Section Gangs; The Maintenance of Curves; Heaving Track, Its Causes, Control and Maintenance; Anchoring Track (to Meet Present-Day Traffic Conditions); The Roadmaster's Qualifications and Duties; and The Utilization of Roadway Machines.

Atwill Opens Convention

William Atwill, vice-president and general manager of the Illinois Central, welcomed the convention to Chicago. He commended maintenance of way men for their accomplishments during the trying times of recent years, and expressed confidence in their ability to carry on through whatever may come in the days ahead. "Maintenance of way men know how to do things," he said. "Through all of my experiences up through dispatcher, trainmaster, superintendent, etc., I have always found maintenance of way men a backstop in time of emergency or trouble." Continuing, he spoke of the increasing problems that have confronted maintenance forces of late in the light of reduced earnings and curtailed expenditures, and characterized as "remarkable," the job that has been done by the track forces under these conditions in meeting the increased demands that have been made on the track as a result of radically shortened schedules and heavier power. "All of this has required a high degree of ingenuity," he said, "which I am sure will be continued to meet the still increasing demands for better service and economy in the future."

Continuing, Mr. Atwill spoke of the large number of roads in receivership, and pointed out that under private ownership, it is essential that the roads be able to earn not alone their fixed charges, but also a fair return on the investment in their properties.

W. O. Frame
President

Mr. Frame was promoted to assistant superintendent of the Wymore (Neb.) division of the Burlington in August, 1936, after serving for 30 years as foreman, roadmaster and district engineer in charge of track maintenance. He is representative of that increasing number of track maintenance officers who are being promoted into operating positions.

Speaking of the immediate future, Mr. Atwill saw many uncertainties which made it impossible to be very optomistic. "What the railways need is increased income," he said, "a problem that is made increasingly difficult in the face of subsidized competition on the highways and waterways and in the air." "The railways are still confronted with a tremendous struggle to remain solvent," he continued, "a situation that demands that every railway dollar expended, including every maintenance of way dollar, be stretched to the maximum through increased economy and efficiency."

Greetings

President F. E. Morrow of the American Railway Engineering Association, extended greetings to the convention in behalf of his organization, speaking in part, as follows:

There is a kinship between our associations since the fields of activity of your association and of ours are closely allied and the relations between your members and our members are very close. Furthermore, the objectives of our two associations are identical, namely, to perfect the materials and methods used in the construction and maintenance of roadway and track to render the maximum of service to our roads at minimum expense. While we approach these objectives from somewhat different viewpoints, the end sought is precisely the same.

The conditions under which we have both worked during the last several years have been and are still very severe and trying. It is comparatively easy to maintain our railroads properly when an abundance of materials and labor is available for that purpose, but it is a task requiring great skill, alertness and ingenuity to perform this task successfully when these requisites are available only in a minimum quantity for so long a period. I feel that the roadmasters have met these conditions most successfully and are to be congratulated most heartily upon their accomplishments under such trying conditions.

Any person would be bold to attempt to penetrate the fog of uncertainty which surrounds us on every hand and to forecast what the future will unfold, but, whatever it may be, I am sure that members of your association, steadfast in their faith, will perform their part in the future, as they have in the past, in a most efficient manner.

Greetings from the American Railway Bridge and Building Association were extended to the convention in a letter from C. M. Burpee, its president, who was unable to be in attendance, but who wrote in part, as follows:

During the last few years, and especially during the last 12 months, national, state, local and individual life has been fraught with many doubts and uncertainties. Would

that our politicians had read, marked, learned, and inwardly digested a book of rules patterned after that followed in conservative railroad operation,—the better to insure and protect personal well-being and happiness, not alone for the present, but for the future as well.

The vicissitudes and uncertainties of national life have so adversely affected railroad operation, perhaps above all other forms of trade and commerce, that we now realize full well the results of national economic muddling and wholesale departure from tried policies which have resulted in our latest business depression. It is somewhat remarkable that in the face of such conditions, those of you responsible for the direction of the work of the association have carried on this year so ably and so well a work of such importance and of such value to the railroads of this continent.

One of the most important functions of your association is to provide means for a free interchange of thought concerning valuable methods and means of carrying on track work. An individual responsibility rests upon each member in this connection, and I urge each of you to take your place upon the floor, when occasion presents such opportunity, for the addition of valuable data to the records. The merits of the association are judged by its accomplishments and those accomplishments are attained only through combined individual efforts.

President Frame's Address

In a review of the activities of the association during the last year, which he viewed with some satisfaction, President Frame stressed the importance of the association work to its members individually and to the railways they represent, and then expressed full confidence in the association and its members to face successfully the increasing problems that lie ahead of them. He said in part, as follows:

This association has the proud distinction of being the oldest of its kind. That it has survived so long, and is today active, strong and influential, is a tribute to the soundness of the ideals of its founders and to the officers and members who have worked actively in its behalf down through the many years of its existence. I am firmly of the opinion that the present membership measures up to the standard set, and that it intends to take no backward step, but rather is determined to work progressively toward the solving of the more difficult problems constantly being encountered as the responsibilities placed upon it become greater and the complexity of its work increases.

Each of our technical committees this year contained more members than has heretofore been the practice. The large number of members volunteering for this work made it possible to give each committee unusually wide representation. In this respect, the association has been most fortunate in securing both chairmen and members who have had wide experience and who have taken their work seriously. The results of such co-operation, I am sure, will be fully compensating, for there is no question but that the benefits we derive from association work bear a close relation to how much we contribute to it.

I desire to emphasize the importance of continually gaining new members, for our present membership is not as large as is necessary to cover the field completely. There are still a large number of men eligible for membership who would profit by working in the association and who would be of value to the association, who are not affiliated with us. It is important that we contact our fellow roadmasters and others eligible to membership, get them to join the association, and then induce them to take an active part in association activities.

From the reserves of young men now getting their training in maintenance work through both practical and technical courses, the railroads must draw in the future for their maintenance officers, and this association, living up to its purpose as stated in its constitution—"to meet and discuss

A. H. Peterson
First Vice-President

F. B. La Fleur
Second Vice-President

C. A. Lichty
Secretary

E. E. Crowley
Treasurer

Roadmasters Association

Officers 1937-38

W. O. Frame, president, assistant superintendent, C. B. & Q., Wymore, Neb.

A. H. Peterson, first vice-president, managing editor, Railway Engineering and Maintenance Cyclopedia, Chicago.

F. B. La Fleur, second vice-president, roadmaster, Sou. Pac., Lafayette, La.

C. A. Lichty, secretary, Chicago.

E. E. Crowley, treasurer, roadmaster, D. & H., Albany, N. Y.

Executive Committee

B. E. Haley, past president, general roadmaster, A. C. L., Lakeland, Fla.

(Terms Expire September, 1941)

G. L. Sitton, chief engineer maintenance of way, Southern, Charlotte, N.C.

E. L. Banion, roadmaster, A. T. & S. F., Independence, Kans.

(Terms Expire September, 1940)

R. L. Sims, district engineer, C. B. & Q., Galesburg, Ill.

W. H. Haggerty, supervisor, N. Y., N. H. & H., Harlem River, N.Y.

(Terms Expire September, 1939)

R. H. Carter, assistant general yardmaster, I. C., Chicago.

— — — — — —

— — — — — —

(Terms Expire September, 1938)

J. J. Clutz, supervisor, Pennsylvania, Trenton, N. J.

T. F. Donahoe, supervisor, B. & O., Pittsburgh, Pa.

questions pertaining to maintenance of way, and to raise the standard of work committed to the charge of its members"—has a definite place in helping to develop and guide these men.

Ours is an organization of practical men. It does not in any way duplicate or infringe on the work being handled by other professional organizations in the railroad field. Working with our organization is The Track Supply Association. Their exhibit is an impressive demonstration of the progress that has been made in tools and equipment. Maintenance of way expenditures now and in the future will go much farther because of the material improvement that has been made in the design and construction of tools and equipment.

We of this association today have been confronted with constant and ever-changing problems as the weights of locomotives and cars have increased, as train schedules have been shortened, and as labor conditions have varied. In meeting these conditions, our association has not proved wanting, and I have every reason to believe that we will carry on in a way that will be fully in keeping with our accomplishments of the past.

Using Track Labor Efficiently

BY F. S. SCHWINN

Assistant Chief Engineer,
Missouri Pacific

In the face of great difficulties during the depression and the following recession, you have maintained the track structure above the expectancy of many. This could not have been possible but for the efficient use of labor.

How have you used track labor efficiently? The reorganization of your forces has been an important factor. You have organized a portion of your track labor into gangs designed for performing particular tasks, such as rail laying, ballasting, surfacing and renewing ties. The labor in these gangs was supplemented with equipment developed for improving the quality of the work, as well as reducing the time element, and such gangs have been able to perform their assigned tasks with greatly reduced interference with train operations. Section forces have been reorganized, with a reallocation of maintained mileage and in many instances they have been relieved of certain duties which could be assigned readily to other employees operating special equipment, designed for the purpose, over more extended territories.

F. S. Schwinn

With the reorganization of forces, you have found it necessary to have better trained labor. The individual is not so much a "jack-of-all-trades" as formerly, although the section laborer must always be able to perform almost any type of track work. With extra gangs and other forces working with special equipment, the individual has been selected and trained to perform certain work and has quickly become highly proficient in that work. This has gone a long way toward attaining the efficient use of labor.

Track Laid With 112-Lb. Rail on the Missouri Pacific Lines in Texas

Special Equipment

It is not possible to discuss track labor without referring at least briefly to the special equipment which has been made available for use by the track man. Such equipment has had a very decided effect on efficiency. The list includes machines for laying rail, wrenching and dewrenching bolts, adzing ties, jacking track, pulling and driving spikes, renewing ties, cleaning ballast and other purposes applicable to the work of the larger gangs. Then for ordinary maintenance, in addition to some of the foregoing, machines have been developed for mowing weeds, burning weeds, discing and shaping ballast, ditching cuts and similar operations. Added benefits have been obtained from an enlarging variety of off-track equipment, frequently tractor mounted, including draglines, front-end loaders, bull-dozers, cranes and hoists. Motor trucks have lately become a part of your equipment for the prompt movement of your track forces within a reasonable distance. You have not been slow in realizing and taking advantage of the benefits in greater track labor efficiency which is possible through the use of such special equipment.

In recent years, you have done a great deal for your efficiency by developing and adopting many up-to-date practices which have had a material effect on the amount of track labor required to meet a certain traffic volume over a given period of time. An outstanding example of this is in the improvement of joint conditions by building up rail ends and the use of various devices designed to provide

tight joints. Aside from the saving in materials, such practices have had a definite effect on the elimination of labor waste.

Efficiency in any field depends very largely on a well-conceived and properly-executed program and this is particularly true with respect to the labor side of maintenance costs. You are giving more attention to this important feature and you are planning your track work in such a manner as to permit more nearly normal forces to be engaged throughout the full year. Track work is no longer largely a seasonal occupation wherein untrained labor must be employed for comparatively short periods. You have also gone far in your efforts to increase efficiency by making the work more interesting and attractive as the result of generally improved working conditions.

How About the Future?

I have referred to a number of things that have been done, and well done, during recent years—all with the purpose of using track labor efficiently. But what about the future? Considering railroad conditions of the present and the probable conditions of the future, the many restrictions placed on their operation and management, the growing importance of competing forms of transportation, both regulated and unregulated, and the gradually changing social conditions apparent in this country, do you anticipate any material increase in the amounts allocated for your use in employing track labor? It is my guess that there will be little or no such increase during the next few years, even in the face of the hoped-for increase in demands upon the tracks. More will be expected from you in the future than has been in the past. What are you going to do about it?

The trackmen of this country are fighters, and you will tighten your belts another notch or two and continue the battle of maintenance. You will not be satisfied with your present methods of organization and training; you will seek better equipment and a further improvement in your practices; you will find better ways of using your track labor efficiently.

The Roadmaster's Job

By FRED G. GURLEY

Assistant Vice-President
Chicago, Burlington & Quincy

Addressing the convention on Wednesday afternoon on the problems confronting maintenance of way men, and more particularly the roadmasters, Fred G. Gurley, assistant vice-president of the Chicago, Burlington & Quincy, said, in part, as follows:

The men of your organization should be commended for the way in which you have carried on your very important part of the railroad business during recent years. When we consider that in the seven years prior to the beginning of the depression in 1929 there was expended for maintenance of way and structures more than three-quarters of a billion dollars a year and that in the succeeding seven years that expenditure has decreased more than 46 per cent, in the face of increased train speeds and ideas of comfort, it demonstrates very clearly that the roadmaster's job has been pretty well done.

Listening to the discussion of your report on the maintenance of turnouts to avoid derailments, brings to my mind a subject that has been very much before me during the last few years—the relationship between the track and motive power departments. On those roads with which I am familiar, there has been a lack of coordination between these departments. Let us think for a moment of the dynamic augment or hammer blow that is delivered on the track by a high-speed locomotive. As late as 1930, we purchased some Hudson type passenger locomotives that were the finest that the locomotive builders and the engineering brains of the railroads knew how to build at that time. At a speed of 80 miles an hour, these locomotives had a dynamic augment of 18,521 lb. Recently we worked over these engines, and as the result, these engines, at the same speed of 80 miles an hour, now have a dynamic augment of only 4,835 lb., a reduction of 74 per cent. In 1930, we acquired some fine 4-8-4 type locomotives, which are typical of the highest type of dual service locomotives. These engines had a hammer blow, or dynamic augment, of 11,833 lb. at 60 miles per hour. We built five more of these engines this year, and they have a dynamic augment of 3,629 lb. at 60 miles an hour, a decrease of 69 per cent.

Fred G. Gurley

There has come a realization, too, on the part of the motive power and track departments that snubbers and shock absorbers are important on heavy equipment. It is my prophecy that you will not see any large amount of freight equipment, locomotives or tanks, running around the country in the future that is not equipped with some kind of shock absorber or dampener that will prevent it from transmitting undesirable and unnecessary blows to the track structure.

I think too, that there is now a greater realization upon the part of managements that it is wiser and more economical to spend money for better improvements in the beginning, than to pay it out in maintenance as time goes on. This applies to such devices as tie plates and rail anchors, rail joints and all sorts of material which produce economy in the end. This is true particularly by reason of the fact that we probably face an upward trend in labor costs.

What is the roadmaster's relationship to some of these things? I think that it is up to all of us to recognize what we can do and what we cannot do, and if we will do that intelligently and calmly, we will find that we can accomplish a lot more than we thought at first was possible.

Many people in America believe in government ownership of the railroads. We must face this fact. There is not, however, any general desire

for it. If government ownership comes, it is my firm conviction that it will come not because of any public clamor for it, but because the railroads will find it impossible to meet their financial obligations because of a drying up of credit and an inability to raise money by any other processes. I believe that all of the economies that could possibly be produced by any government owning all the railroads and eliminating what has been termed wasteful competition, can be secured by consolidations, and at the same time preserve that which we hold dear in this country—private initiative.

All of us have little spheres of influence. You roadmasters, meeting, as you do, so many people, can well afford to devote some thought to this broader aspect of your job. Study the recently prepared A.A.R. pamphlet on the railroads' program. You will find it very educational.

Two of the greatest and most effective human characteristics are curiosity and imagination. I rank these next to integrity itself. If all of us will hang up in front of our mind all the time the one short word, "why," and every time we look at a job and every time we make a decision, we will look through that word, we will begin to wonder why we do it that way. Why is it not done another way? Why it is always done that way? By so doing, you will find a tremendous field open to you that will be of very material benefit to you and to the company you represent.

There is an old saying about taking up the slack. If you will be just a little more curious, put a little more imagination into your thinking and meet these new conditions as they arise with that sort of mind, you will continue to make a success of the roadmaster's job.

The Materials and Equipment for the Section Gang of Today

Report of Committee

IT is conceded that section gangs cannot function economically or safely without good tools that are in proper condition. They must be of proper specification, carefully inspected and used according to the standard practice of the railroad.

A list of tools for the section gangs of any particular road can be prepared only by the men having that authority on the road in question. No general list will fit conditions on all roads. The territory in which a railroad operates has a definite bearing on the articles needed in maintaining its tracks. Several tools that are essential in mountainous districts are of little use in level territory. A railway in the far south has no use for snow fighting equipment, while on a northern line this equipment is very important. The tools required, therefore, vary with the terrain and climatic location.

The make-up of a tool list is influenced also by the type of ballast; if cinders or sand are used, scoop shovels will be needed for considerable time will be lost in handling these lighter ballasts with a standard No. 2 track shovel, although the No. 2 track shovel will be used for tamping. Similarly, if the ballast is stone or slag, ballast forks are required for handling and tamping bars or picks for tamping the track.

With these variations in mind, the committee submits a tool list for use as a guide. This list should be of assistance to a railway that is revising its existing tool lists for it is as up-to-date and complete as the committee can make it.

This list covers practically all tools and equipment used by section gangs

M. D. Carothers
Chairman

in the United States, regardless of location, terrain or type of ballast and for that reason contains some apparent duplications, as for instance, motor cars and hand cars, but it can easily be modified to fit any particular section. There are 105 items in this list; for the four-man gang there are 299 different items and for the 10-man gang, 454. Few section foremen can go into their section tool houses and inspect their tools for 15 min., then go outside, close the door and write a list of all the tools in the building. For this reason the committee feels that a tool list is important, should be kept up-to-date and a copy furnished each section as a guide for the foreman so that he will know what tools he is supposed to have in order to carry on his track work successfully.

It is a task for supervisory officers to keep their section forces supplied with the proper number of each class of tools, for, as can be seen from the above list, there are nearly 300 articles in every section tool house. A tool list assists the supervisor in making a check.

All supervisory officers know how easy it is for some section foremen to accumulate extra tools at their headquarters. There are innumerable ways in which he can add to the number. One of the easiest ways is to assist at cleaning up a wreck or to help a neighbor foreman complete his work. The foreman who is always able to get these tools usually marks all his tools before leaving his headquarters. While the work is in progress, the men and the tools get pretty well scattered. The foreman who has his tools marked, is always able to identify all his tools and a few extras get loaded along with the marked tools. When this happens, the one foreman has extra tools while the wreck crew or the neighboring section is short some tools. The foreman who is short checks his tool list, making a requisition for tools lost at derailment. It is a big task for the supervisor to check the number of tools, so he approves the requisition for additional tools.

Another source of additional tools is to find them out along the right-of-way where they are left by careless foremen. In checking tool lists almost every section will be found to have several extra scoop shovels which have fallen from locomotives. These are collected at the tool houses, as are other tools and materials.

Foremen should not be permitted to leave their tools along the right-of-way as this creates a hazard. With such tools as claw bars, jacks, wrenches and spike mauls, trespassers or others can make track unsafe for traffic in a few minutes.

Tools are lost each year where extra gangs and large section gangs do seasonal work and leave their tools along the right-of-way. Section foremen like to collect these tools as they think that they will find a use for them sometime.

With all of its tools and materials, it is quite a problem to arrange the section tool house so that it makes a neat appearance. Rainy days when little work can be done on the track provide opportunity to clean house and put all tools in good repair. The section tool house gives one a very good line on the kind of foreman running the section. If he has a neatly arranged tool house, with all materials in their proper places, he will likely have a good section. However, few railroads give their section foremen a plan showing a standard arrangement of section tool houses; this is usually left to the supervisor, who inspects the territory, and he in turn probably leaves it to the judgment of the section foreman.

List of Tools for Track Section Gangs

Tools	No. Men In Gang 4	6	8	10
Adzes with handle	2	2	3	4
Axes with handle	1	1	1	2
Bars, claw	2	3	3	4
Bars, tamping	4	6	8	10
Bars, lining	4	6	6	8
Barrows, wheel	2	2	2	2
Batteries, dry cell	6	6	6	6
Bender, rail	0	0	1	1
Bits, track	4	4	4	6
Blades, hack saw	6	6	6	6
Boards, slow speed	2	2	2	2
Boards, resume speed	2	2	2	2
Board, track level	1	1	1	1
Board, spot	1	1	1	1
Boxes, tool	0	0	0	1
Brooms	1	1	1	2
Brooms, straw	4	6	8	10
Brushes, whitewash 6-in.	2	2	2	2
Brushes	1	1	2	2
Buckets, water 3-gal.	2	2	2	2
Buckets, whitewash	1	1	1	1
Burners, switch lamps	2	2	4	8
Burners, lanterns	2	2	2	2
Can, oil, 2-gal.	2	2	2	2
Crayons	3	3	6	6
Can, oil, 5-gal.	2	2	2	2
Cars, motor	1	1	1	1
Cars, hand	1	1	1	1
Chisels, track	4	6	6	8
Chisels, cold ⅞ in.	1	1	1	1
Chain, locking push car	2	2	2	2
Canvas, for motor car	1	1	1	1
Dippers	1	1	1	2
Drill, track	1	1	1	1
Drivers, screw 6-in.	1	1	1	1
Files, flat 10-in.	1	1	1	1
Flags, red	4	4	4	4
Flags, green	4	4	4	4
Forks, ballast	4	6	8	10
Frames, hack saw	1	1	1	1
Funnels, 2-qt.	1	1	1	1
Fusees	12	12	12	12
Gage, track	1	2	2	2
Globes, lantern white	2	2	2	2
Globes, lantern red	2	2	2	2
Globes, lantern yellow	2	2	2	2
Globes, lantern green	2	2	2	2
Goggles, pair	4	6	8	10
Grinders, tool	1	1	1	1
Grindstone and frame	1	1	1	1
Hammers, claw	1	1	1	1
Hammers, sledge 10-lb.	1	1	1	1
Hatchets	1	1	1	1
Handles, adze	2	3	3	4
Handles, axe	1	1	1	1
Handles, jack	2	2	2	2
Handles, spike maul	6	6	12	12
Handles, pick	8	8	12	12
Hooks, brush	2	2	2	2
Jacks	2	2	4	4
Kegs, water, 5-gal.	1	1	0	0
Kegs, water, 10-gal.	0	0	1	1
Keys, switch	1	1	2	2
Keys, tool house	2	2	2	2
Kits, first aid	1	1	1	1
Lines, ditching	1	1	1	1
Lanterns, white	2	2	2	2
Lanterns, red	2	2	2	2
Lanterns, yellow	2	2	2	2
Lanterns, green	2	2	2	2
Locks, car house	1	1	1	1
Locks, switch	6	6	6	6
Mauls, spike	4	6	8	10
Mattocks	1	1	2	2
Oilers, squirt	1	1	1	1
Pliers	1	1	1	1
Picks, clay	4	6	8	10
Picks, tamping	6	9	11	12
Pins, drift	2	2	4	4
Pullers, spike	1	1	1	1
Punches, track	1	1	1	1
Rakes, garden	1	1	1	1
Saws, crosscut	1	1	1	1
Saws, hand	1	1	1	1
Shovels, tamping, No. 2	6	8	10	12
Shovels, scoop	4	6	8	10
Shovels, long handle	2	3	4	5
Shovels, snow	4	6	8	10
Snaths, scythe	4	6	6	6
Spark plugs	1	1	1	1
Tamper end	2	2	4	4
Tapes, 50-ft.	1	1	1	1
Tongs, rail	2	3	4	5
Tongs, tie	4	4	6	6
Torches	4	6	8	10
Torpedoes	50	50	50	50
Track liners	2	3	3	5
Trays, oil	1	1	1	1
Waste, lb.	5	5	10	20
Wrenches, monkey	2	2	2	2
Wrenches, track	5	7	9	11
Wicks, lantern	6	6	6	6
Wicks, switch lamp	6	8	12	12
Whistles, warning	1	1	2	2

Must Report Poor Tools

Maintaining a good set of tools on each section requires the co-operation of the section foreman and the supervisor. Sometimes when tools are sent in for repairs, they are returned improperly tempered or improperly shaped. In either case the tools have little value and valuable time is lost in trying to use them. The shop foreman in charge of the repair of tools will never know about these conditions unless they are called to his attention; the section foreman should, therefore, make it a point to call his supervisor's attention immediately to any tools that have been received improperly repaired. Likewise, materials and tools are sometimes received from the stores department that are not in first class or usable condition. Crooked handles may be sent out, which will necessitate requisitioning additional handles, or new tools, such as track chisels, are sometimes received from the manufacturer improperly tempered and fail almost as soon as put in service. Unless these conditions are called to the attention of the stores department, the purchasing agent will probably make no change in his purchases as he will consider that the materials and tools he is buying are giving satisfactory service.

The Condition of the Tool House Gives One a Good Line on the Kind of Foreman Occupying It

Most railroads have equipped their sections with motor cars, which not only get the men to their work out on the track with less delay but fresher. A motor car receives a great deal of use in a year's time, particularly if it is operated on a long section. Every two to four years, depending on the amount of use it receives, it should have a general overhauling. After two or three such overhaulings it is usually found to be cheaper to scrap the old car and buy a new one. On several roads the purchase of a new car is considered when materials and labor to repair the old car equal 75 per cent of the price of a new car.

The section foreman has a real problem in arranging his men and his tools in the limited space on his motor car so that he can transport them to and from work safely. Sometimes when the foreman is working a large gang he may require a push car and a trailer car to carry additional men and tools. It can be said that many motor car accidents have been caused by poor judgment on the part of the fore-

man in arranging his tools on the motor car or push car. Some of these accidents have resulted in fatalities. The tools most likely to cause accidents are lining bars, track jacks and water kegs.

The list shows torches and lanterns for illumination. Some roads use carbide lanterns, also oil inspection lanterns. It is difficult for section forces to do good work at night at derailments or washouts without good lights. The committee recommends that a good lighting outfit of some approved type be kept on each supervisor's territory so that when an emergency arises the men will have suitable light to work with. It is difficult for section men to build track at night with the old-time torch and lantern.

Good Tools Are Essential to a Good Day's Work

List Varies With Gang Size

As stated, the materials required on each section will vary according to the location and the kind of section. For instance, on yard sections a large amount of track material will be used daily, while on main line sections the material needed will be ties, both main line and switch, a few emergency rails, (usually one for each mile of main track) enough spikes to make tie renewals during the tie season, enough bolts to make such bolt renewals as may be required and switch material in amounts depending upon the number of switches maintained. In most territories the supervisor carries a stock of material at some convenient point to take care of any emergencies. Materials such as angle bars, tie plates, track shims, anti-creepers and other track materials are furnished from the storekeeper to the section on which it is to be used.

The committee has presented the number of tools to be provided for section gangs of 4, 6, 8 and 10 men. It has been brought out, however, by some of the co-operating roads that the list should be further reduced for smaller gangs. A reduction in the size of the gang considerably lessens the supply of tools and promotes greater economy. Furthermore, where supervisor's headquarters are so located and train service is adequate, several tools shown on this list can be carried at the supervisor's headquarters and dispatched to the section foreman when needed.

The maintenance of way department, through its storekeepers, supervisory maintenance officers and its section men, can play a very important part in saving in the use of materials and tools by seeing that the tools and materials on the various sections are in proportion to the number of men allowed on each section.

In conclusion, the standard of maintenance of any railroad varies with the kind and quality of the tools and materials furnished. The foreman and his gang can be judged by the tools they use. Therefore, we recommend an economical list of good tools and materials for the section gang.

Committee—M. D. Carothers (chairman), div. engr., Alton, Bloomington, Ill.; W. F. Monahan (vice-chairman), gen. track insp., S. P., San Francisco, Cal.; C. E. Morgan, supt. work equip. & weld., C. M. St. P. & P., Chicago; S. W. Payson, rdm., St. L.-S. F., Enid, Okla.; R. D. Copeland, rdm., Ann Arbor, Owosso, Mich.; J. F. Beaver, track supv., Southern, Greenville, S. C.; R. E. Meyer, rdm., C. & N. W., Mason City, Iowa; C. Pfeifer, supv., E. J. & E., Joliet, Ill.; E. J. Brown, rdm., C. B. & Q., Chicago; W. H. Sparks, gen. insp. track, C. & O., Russell, Ky.; J. H. Morgan, engr. maint. of way, F. E. C., St. Augustine, Fla.; D. Maconi, track supv., N. Y. N. H. & H., Franklin, Mass.; I. H. Schram, engr. maint. of way, Erie, New York; F. B. LaFleur, rdm., T. & N. O., Lafayette, La.; M. H. Dick, eastern ed., *Railway Engineering and Maintenance*, New York; M. C. Taylor, supv., L. & N., Latonia, Ky.; M. D. Clark, rdm., S. A. L., Raleigh, N. C.; H. H. Britton, supv. track, N. Y. C., Adrian, Mich.; D. Barksdale, rdm., I.-G. N., San Antonio, Tex.

Discussion

Opening the discussion on this report, President Frame pointed out that the list of tools submitted should form a valuable guide to maintenance officers in seeing that their forces are properly equipped. He said he was particularly impressed with the recommendation that a printed list of tools be posted in each section tool house. "How can a foreman know what he should have, or whether he has too many or too few tools," he questioned, "unless he has something to check against."

J. J. Clutz (Penna.) pointed out that each foreman on his road is provided not only a standard tool list, but also a standard plan for bin and rack arrangement for the storing of tools and materials. "As a result," he said, "foremen are enabled to arrange their houses in the most orderly manner, and the work of the supervisor in making a periodic check of the tools and materials on hand, is greatly simplified."

F. B. La Fleur (S.P.) emphasized the importance of that part of the report dealing with the proper arrangement of tools on motor cars, and cited a case on his road where the improper loading of tools, which permitted a lining bar to fall from a car in motion, caused the fatal injury of a foreman. "All foremen," he said, "should be impressed with the importance of the proper loading of tools."

Turning to the specific list of tools submitted by the committee, G. L. Sitton (Southern) questioned the sufficiency of the two jacks suggested for four- and six-man gangs and then offered the suggestion that, although not included in the list, every gang should have a trailer or push car to transport tools and materials. Speaking for the committee, Mr. La Fleur agreed with Mr. Sitton, and said that on his road all section gangs have trailer or push cars and find them invaluable.

Mr. Clutz suggested that to be complete, the list should include two-wheel rail dollies for transporting individual rails or a few ties. He also suggested the advisability of differentiating between the various sizes of jacks and types of ballast forks which are now being furnished to section gangs on some roads to meet varying conditions. Another suggestion for an addition to the list of tools was made by R. L. Fox (Southern) who mentioned metal slow boards and resume-speed boards. Mr. Clutz also questioned the advisability of including jack handles in the list, pointing out that on a number of roads old style jack handles have been superseded by lining bars with a square section near their pointed end, specifically to adapt them for use as jack handles.

T. F. Donahoe (B. & O.) asked for advice concerning improvements in coupler connections between motor and push cars, especially to meet the condition where the present short coupler makes it difficult to transport a rail on the push car. Replying, Mr. Fox said that he had used a 12-ft. length of 2-in. pipe successfully, with suitable ends, secured with pins and cotter keys.

Chairman Carothers stressed that part of the report dealing with suitable lighting equipment for the section gang to permit carrying out night work. He cited the difficulties under which gangs must work if provided only with lanterns and torches, and suggested that where it was not advisable to equip each section gang with special lighting equipment, the supervisor should have a special lighting outfit of some kind which could be rushed to any gang that required it for special night work. In addition, he cautioned against such dangerous methods of securing emergency light as lighting gasoline in open containers.

E. E. Crowley (D. & H.) pointed out that wrecking outfits always have special lighting equipment that can be borrowed by the track forces at the site of a wreck or derailment, but pointed out that where this cannot be counted upon or is inadequate, inexpensive carbide flare lights, which, set in a pail of water and ignited, burn for 3½ to 4 hr., have been found highly effective and economical. Mr. La Fleur agreed with Mr. Crowley that some such inexpensive type of emergency lighting equipment should be made quickly available to the section forces for night work, but felt that the more expensive types of lights could not be justified for each section gang.

The Maintenance of Line and Surface to Meet Present Day Operating Requirements

Report of Committee

E. L. Potarf
Chairman

AMERICAN railroad history is a record of continuous achievement over more than a century, but progress in the last five years has probably been more spectacular than during any similar period in the life of the industry. An outstanding development has been the increase in train speeds, which, while appealing to the traveling and shipping public alike, has multiplied the problems confronting maintenance men. Freight trains are now scheduled almost twice as fast as they were prior to 1930, while passenger speed limits of 80 miles per hour with standard equipment and up to 100 miles per hour with special light weight equipment, have become rather commonplace.

Operating requirements may vary from year to year but today, more than ever before, emphasis is placed upon economically maintaining a railroad suitable for these higher speeds, with perfect safety. This aim is being realized, for in the face of declining revenues and drastically curtailed maintenance expenditures, faster trains are being run with a higher standard of passenger comfort than ever previously existed.

The committee report delivered before this convention in 1936 on Preparing and Maintaining Track for High Speed Operation, fully covered the details surrounding the half-dozen super-speed trains then in service. Since that time the number has increased many times, and such trains are now operating from one border of the country to another. Your committee, in order to obtain data showing the influence of these changes on track maintenance, submitted a questionnaire to various association members, and received replies covering nearly 50,000 miles of all classes of track. The information contained therein is presented in the belief that it reflects practices and methods in effect on a typical cross-section of our railroads today.

Modern Schedules—A Factor

Consideration of certain factors directly influencing maintenance may be appropriate here. It is conceded that the light-weight Diesel-powered trains and the specially designed high-speed locomotives have little adverse effect on good track, at the 90 or 100 miles per hour speeds for which they are constructed. However, motive power built for the requirements of years gone by is being called upon to move standard equipment; both passenger and freight, at speeds far above those for which designed.

One such locomotive exceeding critical speeds may cause track damage that will require days or weeks to correct; hence, uniform and reasonable schedules that will permit recovering a slight amount of lost time without extreme bursts of speed are essential.

Slow running is inevitable around terminals, but every permanent intermediate restriction must be considered as a definite source of delay and studied with a view to its removal, or modification to permit the highest possible speed. Improvements that will permit raising several such restrictions five or ten miles per hour will frequently mean that an otherwise difficult schedule may be fulfilled with ease and comfort. Temporary slow orders on ballasting or construction work can be dispensed with, but if it is necessary to close up during working hours for full speed, gang output may be reduced as much as one-third. The ideal schedule will provide some slight latitude for an occasional slow order, but these must be widely spaced and used with the utmost discretion.

Restricting curves breaking up long stretches where continuous top speed would otherwise be possible, are being flattened as rapidly as finances will permit. Earlier methods of calculating the economic worth of curve reduction are not always followed, as the intangible value of passenger comfort may be the deciding factor. Roads reporting comprehensive curve revision programs are reducing to the maximum degree which they feel can be elevated for unrestricted tangent speed, usually about 90 miles per hour.

Some roads maintain that this means going to 1-degree curves, while others feel that a 1 deg. 30 min. maximum is satisfactory. The type of equipment must be considered, as the light-weight trains with their lower centers of gravity and improved springing are comfortable on a given superelevation, where standard equipment at the same speed will produce a sense of crowding. The latter is therefore often operated at speed limits five or ten miles per hour below those set up for the light-weight equipment.

A Well-Tied Roadbed is Particularly Desirable in High-Speed Territory

Grade conditions permitting, the amount of superelevation is governed by the degree of comfort desired, and certain standards tried out in 1935 have since been found inadequate. Roads at that time preparing for 90 miles per hour by placing 2½ in. in 1-deg. curves, soon learned that this was insufficient, and after adding an inch, which produced the desired riding comfort at that speed, have discovered that the curves now hold elevation and stay in line, much more uniformly than before. Elevating one degree curves 3½ in. is now most common, while one large system reports using 4 in. in anticipation of 100 miles per hour speed. A number of roads favor 5 in. or 5½ in. superelevation for 90 miles per hour on 1 deg. 30 min. curves and for 80 miles per hour on 2 deg. curves. One railroad limits elevation to 3½ in. on any curve, reducing speed accordingly; several use 5 in. and many 6 in. as the maximum permitted.

Easements

The belief that runoffs should be made at the rate of about 1¼ in. per second of rise is almost universal, and for the speeds mentioned above will therefore vary from 320 to 470 ft. in length for 1-deg. curves, and up to 560 ft. for 2-deg. curves elevated six in.; approximately the A.R.E.A. standard adopted in 1933.

Full elevation must obtain at the point of full curvature, continuing uniformly around the simple curve. Almost equally important, the spiral should be as long as the runoff so that the relation between curvature and elevation will be exactly the same at every point on the spiral. Earlier methods of using short spirals to reduce track shifting and running part of the elevation out on tangent, are not conducive to smooth riding or easy maintenance, and the practice is discouraged. One-degree curves shorter than about 260 ft. between spirals will not be entirely comfortable at 90 miles per hour, as the time interval between elevation run-in and run-out will not permit the necessary body adjustment. Usually these can be reduced to 30 or 45-min. curves with little work at slight expense, and will then ride nicely.

Alinement

String lining and the transit are each advocated as being the proper medium for obtaining the true curve alinement so necessary with high speed. Several forms of string lining are in favor, from those used by the alert foreman for lining out the flat spots and pulling in the elbows, to the more intricate systems best utilized by the engineering corps, which provide a uniform curve and true spirals, at some increase in the amount of track work involved. A combination of transit and string methods is reported as being well suited to the rapid conditioning of an entire line for increased speed. Several roads use the transit only, setting permanent monuments at control points to aid in future restaking. Fast traffic distorts curve alinement, necessitating frequent checking, and the important thing is to have easily available some means of correction that is definitely superior to lining by eye alone.

Greater refinement is fully as desirable on tangent as on curves. Tangent track only slightly out of line will be noticeable at 90 miles per hour. Much out-of-face lining was done in preparation for fast schedules, and it is customary to set line stakes, or use a lining instrument in connection with ballasting work. No routine job of smoothing track may be called complete, if small line irregularities are allowed to remain.

Variations in gage are magnified as speed increases, and too much stress cannot be placed upon laying rail to truly uniform gage, which the use of the mechanical adzers has simplified, and upon correcting any irregular gage in connection with ordinary maintenance work. One or two roads have laid rail to ⅛-in. tight gage, in an effort to improve riding conditions. In this connection, it may be mentioned that cylindrical tread wheels on high speed equipment tend to reduce the objectionable whipping on tangents, which is sometimes present with cone treads.

Improvements for High Speed

Few roads report greatly augmented programs for replacement with heavy rail solely because of shortened schedules; yet nowhere is the effect of the stiffer rail section more apparent in improving riding qualities than under the very fast trains. A rather formidable mileage of 90-lb. rail remains in track carrying trains at 80 or 90 miles per hour, but it is being replaced with 112-lb. or heavier, as rapidly as the money is available. Special construction, such as continuously welded rail, special tie plates with hold-down devices, special joint plates and the like, all tend towards reduced maintenance, but their ultimate economy will be determined largely by local traffic conditions.

Increased activity in improving worn joints is quite general, as chipped or battered rail ends and bent or worn bars, coupled with ballast that is inclined to whip or puddle, must be corrected by welding and renewal with bars designed to compensate for rail wear, before suitable riding conditions can be obtained.

Minor sags or humps in the grade line, not objectionable a few years back, must now be smoothed out. Uniform cross level is essential, and rigid insistence on the use of the level board in spotting up, both on curve and tangent, is recommended.

Increases in standards of depth of ballast section are reported, and widening of the ballast shoulder on tangent and curve is shown to be rather general, as an aid to holding line and surface. Light ballast may call for replacement with more stable material because of its tendency to whip out under high speeds. All replies show that mechanically tamped track is far

superior to that put up by hand, and small portable spot tamping machines are growing in popularity for section use on hard ballast lines, being especially effective around high speed turnouts and crossings. Apparently, new rail cannot be made to ride properly at 90 m.p.h. by any reasonable amount of spotting up, and surfacing should follow closely behind the relay.

There is still no substitute for good ties on any class of track, and roads which reduced standards slightly during depression years, soon found that tie conditions must be maintained at a higher level for fast than for moderate speeds, regardless of economic cycles. To distribute the effects of high speed impact better, some roads have decreased their usual tie spacing slightly, or increased their standard size from an eight to a nine inch top, and have adopted the 8½-ft. length almost universally. Information from various sources indicates that some decrease in tie life on curves may be expected as a result of faster traffic, possibly as much as ten percent.

Subgrade stabilization is receiving attention wherever soft spots or mud squeezes are found under high speed track. Whether the cure is in the form of French drains, or tile or perforated pipe lines, piling or poles driven along the shoulder, or mats or slabs placed below the ballast section, the result is a smooth riding railroad, with a saving in labor that will soon refund the initial investment.

Replacement of open deck bridges with ballast decks has aided riding conditions by removing a source of troublesome maintenance at just so many bridge ends.

Maintenance Force and Expense

The refinements outlined above as being necessary for present day operation, clearly mean increased maintenance. Last year a sub-committee of American Railway Engineering Association's Committee on Economics of Railway Labor, estimated that this increase would amount to between 10 and 30 percent, or more, depending upon traffic and the physical characteristics of the property. Unfortunately, actual cost figures are still indeterminate, and we can only submit that this estimate is confirmed in replies to our questionnaire.

It is true that reduced traffic everywhere has lessened track punishment, but the studies of the A.R.E.A committee show conclusively that the decline in man-hours worked has more than kept pace with the decline in traffic. This apparent discrepancy between higher maintenance standards and lower maintenance force is due, in part, to the improved design, strength and quality of track materials installed during recent years, in part to savings accruing from the widespread use of labor-saving equipment, and very largely to economies resulting from more efficient organization for, and methods of, performing track work.

As early as 1922 this Association heard it recommended that sections be extended and that maintenance work be handled by special gangs. The gang idea grew rapidly as the economies were recognized and as equipment was perfected, until now most railroads employ fully mechanized gangs to lay rail and to reballast. Only a little less common are similar gangs used to resurface on old ballast, to tighten bolts, to renew angle bars, and to spot and line track out-of-face. Several roads replace all ties with special gangs, and mechanical aids for this class of work are now being developed.

Consolidation of sections began on a large scale about 1930, and has continued intermittently up to the present time. We now find, on a representative mileage of well maintained, high speed railroad, that line sections average from 9 to 14 miles of heavy duty single track, or from 5 to 8 route miles of heavy duty double track. No general increase in the average number of laborers employed per section is apparent since 1930.

Modern High-Speed Train Operation Requires Many Refinements in the Track Structure

Handling the heavy maintenance tasks with special gangs has relieved the section force of practically all of the out-of-face work that was formerly its province, thus enabling it to spend as much as 90 per cent of its time smoothing and lining track. This organization is perfectly suited to high speed operation, with its ever-present demands that small track irregularities be corrected promptly and before they become extensive.

Every phase of maintenance work must have careful, intensive supervision. To aid in overcoming the handicap of extended roadmaster's districts, a number of roads use the track patrolman or track supervisor plan, as described by the Committee on Organization here in 1935, which relieves the section foreman of all track patrol except in case of storm.

Frequent Inspection Necessary

In spite of stronger track construction, it is generally believed that present day speeds call for frequent track and switch inspection. This is accomplished efficiently by the Track Supervisor, who makes a round trip over his territory of 50 to 75 miles three times per week on a light inspection motor car. His observations, coupled with advice from the roadmaster, insure that the spots most needing attention will be corrected expeditiously, and that only the necessary work will be done at each location. Roads using this system report improved riding conditions, with a better quality and output of work, and feel that the plan is economically sound.

With only a definite number of maintenance dollars available, it is inevitable that certain niceties of appearance will be given somewhat less attention. Hand shaping of ballast section, hand control of vegetation, hand ditching and bank-widening have largely disappeared, and this work is now virtually all done mechanically. Labor thus conserved has gone into the maintenance of line and surface.

Maintenance problems are not confined alone to high speed territory. On secondary lines, passenger speeds have increased from 40 or 45 miles per hour to 60 miles per hour and more, with freight trains keeping pace. Instead of light-weight trains and modern locomotives, the older motive power has been speeded up, and the effects on track are too well known to warrant repeating here.

Little rail has been relaid on such lines since 1930, and ballasting has been greatly curtailed. Welding and

joint bar renewals, ditching, bank-widening, and kindred improvements, have been deferred from year to year. The tendency to restrict tie insertions was evident for a few seasons, but it was found that poor ties were responsible for so much wasted labor and improperly riding track, that such conditions have generally been corrected.

No definite improvement programs are noted in connection with the quickened schedules, except where a moderate expenditure to line and surface a few grossly underelevated curves would permit a decided increase in speed. String lining is in favor, for here also, lining by eye alone is not entirely satisfactory for present day speeds.

Much Curve Reduction Work, Such as Is Shown in This Picture, Has Been Necessary to Permit the Sustained High Speeds of Today

Sections have been lengthened to an average of between 10 and 18 miles of single track and up to 12 route miles of double track, with central location of headquarters an important consideration. Tie renewal gangs are favored because of their mobility. With the long sections and small force, almost no out-of-face smoothing is done, and it is impossible to get tangents lined except in the relatively short locations where track is being spotted. This results in line irregularities over long distances, which are conducive to rough track, and special lining gangs show worthwhile economies by correcting this source of increased maintenance.

Supervision and Inspection

Extended sections have also made the Track Supervisor plan more attractive in proportion to the time required for track inspection and care of line switch lamps, that is thus saved the section gang. With the speeds above mentioned, the frequency of track patrol thus obtained is considered desirable. Judicious supervision is more than ever necessary, to insure that all available labor is expended where it will accomplish the utmost in strengthening the track and in improving riding conditions.

Branch Lines

On branch lines the speed trend is sometimes reversed. Wherever possible, train schedules have been lengthened to relieve track punishment, and frequently are governed wholly by the ability to get over a subdivision within the basic day. The lightest available motive power, appropriate to the requirements, is being used, although the obsolescence of small engines and the stepping back of heavy power render this impracticable on many railroads. Diesel units and auto-rail cars are receiving consideration, where the tour of duty can be made extensive enough to justify the investment. Such measures deserve the most careful study because of their effect on reducing maintenance.

Improvements in track structure are confined to the demands of safety. Section lengths have increased all out of proportion to the decline in traffic and now average 20 to 30 miles, with a few reported 40 miles long. Stability of subgrade and weight of rail are the two features most likely to determine the possible length. Section headquarters are centrally situated and the daily working location is coordinated with the requirements for inspection, which may be on the basis of three times, twice, or even only once per week. On a few lines this inspection is handled by an assistant foreman or leading laborer with a small motor car, who also makes sundry light repairs.

Some tendency is noted toward modified out-of-face maintenance. Ties are allowed to go a little longer and are then renewed by a special gang, which also spots and lines the track with the expectation that it will not be touched until the second season. The track may become somewhat rough, but not seriously so if tie conditions are reasonably good, and a little picking up by the section force will usually keep the line in shape for the speed and traffic carried. Heavy rail laid and rail anchors placed prior to 1930, and the almost universal application of tie plates during the last decade, are items which have reduced the branch line maintenance burden.

Conclusions

Owing to the wide variety of local conditions, conclusions applicable to all railroads cannot be drawn. Certain generalities, may however, be permitted: Much can be done to relieve track abuse by proper scheduling and the observance of speed limits. Track irregularities are exaggerated by high speed, and smooth riding at these high speeds can only be obtained by greater refinements in maintaining the line and surface.

Special gangs for the heavier tasks and section gangs for the prompt correction of rough spots and for general policing, form an organization well suited to present requirements.

High speed has not called for any radical departure from established maintenance practices, but has merely intensified certain long-standing problems. Much has been learned in the last three years, and today's traffic is continually providing the stimulus for further development in every phase of track work, so that if the future should demand still more speed, maintenance men will be ready with the solution.

Committee—E. L. Potarf (chairman), dist. engr. maint., C. B. & Q., Omaha, Neb.; C. C. Clark, rdm., S. P., Ogden, Utah; M. Donahoe, div. engr., Alton, Bloomington, Ill.; L. Coffel, track supv., C. & E. I., Momence, Ill.; C. J. Jaeschke, div. engr., M. P., St. Louis, Mo.; P. F. Muller, rdm., C. & W. I., Chicago; G. B. McClellen, dist. rdm., T. & P., Marshall, Tex.; J. H. Dunn, rdm., N. Y. C. & St. L., Ft. Wayne, Ind.; F. G. Walter, asst. engr., I. C., Chicago; H. E. Durham, rdm., K. C. S., Pittsburg, Kan.; J. J. Clutz, track supv., Penna., Trenton, N. J.; R. T. Rumbold, b. & b. supv., Southern, Greensboro, N. C.; R. L. Guy, rdm., A. C. L., Thomasville, Ga.; J. B. Martin, gen. track insp., N. Y. C., Cleveland, Ohio; W. H. Haggerty, supv., N. Y. N. H. & H., New York; J. A. Cherwinker, rdm., C. M. St. P. & P., Perry, Iowa; G. S. King, supv., Southern, Branchville, S. C.

Discussion

Discussion centered almost entirely around the question of lining curves and whether section foremen can be depended on to do string lining. It was generally agreed that the curves should be lined to proper

position in the first instance by members of the engineering corps, but that after the curve has been lined originally, the section foreman can well use the string lining method to maintain correct alinement. J. B. Martin (N.Y.C.) stated that foremen can detect defects in alinement by this method that are not visible to the eye.

Some question arose as to the quality of work done by string lining compared to lining with a transit. William Shea (C. M. St. P. & P.) cited instances where, when curves were relined a year or so after the original lining, throws of as much as 7 in. were called for. It was generally agreed, however, that string lining is satisfactory and that it can be done much more rapidly than with a transit. L. E. Thornton (Alton) stated that curves on his road which were lined by the string lining method had held their alinement for more than two years under speeds of 80 to 90 miles per hour. It was the consensus of opinion that the Bartlett method of string lining is superior to other methods and that one of its advantages is that curves can be lined to give smooth riding without much throw.

There was also some discussion about whether stakes should be set permanently for alinement. It was generally agreed that it was better, after the curve has been thrown, to discard the stakes.

Methods of Instructing Track Men in Safety

Report of Committee

F. E. Schaumburg
Chairman

OF first importance in securing satisfactory results in accident prevention work, is that all supervisory officers shall be in sympathy with the safety movement. Unless this prevails, it will be most difficult, if not impossible, to instruct or interest men in safety, no matter what methods are used. In order to be good teachers of safe practices, supervisory officers must practice what they preach and observe safety instructions to the letter themselves.

How often this fact has been brought home to us. We have all mingled with our men, after a visit by a group of general or division officers, and heard such remarks as, "Why do those officers step on rails and pass so close to the ends of cars, when they have issued instructions to us that we must not do these things?" This is true of our every action while in the presence of these men whom it is our duty to protect and teach the proper way of doing their work in order to avoid injury. Therefore, when we attempt to teach and instruct these men in safe practices, it is up to us, as supervisors, to live up to all of our instructions to the letter if we are to be successful in our safety campaign.

When an accident happens it should receive the immediate attention of the roadmaster. Usually an investigation is also conducted by the division engineer, the division superintendent and the safety supervisor. Statements are taken from all who were present at the time of the accident. These statements bring out the exact facts of the case, as to what caused it, who, if anyone, was responsible and whether any equipment, tools or material had anything to do with it. All this information is passed up through the regular channels until it reaches the officer in charge of operation. Here it and it's accumulated attachments and recommendations are given very careful study. After this has been done we find that the actual instructions are born for the prevention of a similar accident elsewhere. These instructions are now sent back down through the many hands until they finally come to rest on the desk of the roadmaster.

Written and Oral Instructions

Now that the roadmaster has the written instructions on his desk, what is to be done to get the idea before his men in such a way as to put it over successfully? Does he merely sit down and quote the instructions to his men and then forget about them? He should not. His interest should be and most generally is, much deeper than that. Of course the instructions must be issued in writing, but he goes further and personally contacts all of the section gangs. While in their presence he gets all of the men together and goes over the instructions orally and in an interesting manner. Whenever possible he demonstrates how the accident happened and what could have been done to avoid it.

At best, written safety instructions are dry and uninteresting reading matter, so it has been found that the personal and verbal appeal by the roadmaster has brought very good results. You can recall cases on your own districts where a foreman was found violating instructions issued only a few days previous and his excuse was that he did not think anything could happen by doing it that way. After proper explanations as to what brought about the instructions and what had already happened, he was quick to appreciate their importance, and more than willing to obey them.

Merit Award System

Many railroads have instituted a merit card system, whereby each foreman who, with his entire gang, goes an entire year without a personal injury, receives a safety merit card indicating this fact. If the same gang goes another year or more without any injuries the card so indicates. In addition, signs are hung up on the tool house, outfit cars, etc., to indicate that there have been no injuries in that gang during the year or number of years as the case may be. Track men have shown a great deal of interest in these cards and signs, and each member of the gang does everything in his power to secure the first card and sign, or to maintain a clean record once it has been established.

Some railroads require employees to report violations of safety instructions on a form printed for that purpose. This form shows the name of the offender, the rules or instructions violated, and the location, date and time the violations were noted. The employee then signs the card and forwards it to his immediate superior officer. These cards are not used for purposes of discipline, but rather for notation on the employees safety record. The violation is, of course, called to the attention of the employee involved, with the request that he discontinue such unsafe practice. The dangers of such violations are also pointed out to the man, with the possible results of such continued misconduct.

While this system has done much good in eliminating unsafe practices, it has not been as much of a success as was first expected for the following reasons. First: This card was first used as a form of discipline and for this reason it caused a great deal of ill feeling among the men. Second: It was the intention to have employees issue these cards against all other employees, regardless of whether they were in their own department or not. This created the wrong feeling between departments. Third: Employees did not at first understand the true purpose of the cards and felt that they were being used as a club over them.

If this system is used it is felt that it should be used for safety purposes only, and not for actual discipline; that employees in one department should issue such cards only against employees of the same department; and that the card should not be issued against an employee in the manner of a threat, since the whole safety structure is built around the plan of protecting the individual against injuring himself or his fellow workmen.

Surprise Checks in the Field

While surprise checks of men actually in the performance of their duty may seem a bit harsh, they have brought unusually good results in many cases. For example: A section gang has previously been instructed carefully how to operate its motor car properly, including the placing of tools, speed of operation, keeping proper lookout in both directions and what each man should do in order to remove the car in an emergency. The roadmaster meets them along the right-of-way somewhere and from a distance, but in plain view, gives them a pre-arranged signal to take the car off the track. The roadmaster can then time the removal of the motor or hand car, as well as observe how perfectly the crew performs its task. He also can tell from his check whether the proper lookout has been placed on both the front and rear of the car, since he may give his signals either from in front or behind the motor car. If he allows the car to pass by him he can determine if it is operated at proper speed or not. After the car has been set off the roadmaster gives the crew credit for making a good emergency set-off of the car, or corrects any faults which he may have detected. He also inspects the car for proper loading of tool trays.

Another example is afforded by a roadmaster coming up to a section gang unnoticed. This gives him an opportunity to see if the foreman has placed his men so that they are not working too close together, also if proper tools are being used, as well as the general details of the action of the whole gang as a unit. After this inspection, he shows himself and makes any necessary comments. He must be careful not to be too harsh in his correction of some improper action on the part of the gang, for he should not make them feel that, in the future, they should keep an eye open for him rather than keep their mind on the work at hand.

In most cases the selection of track laborers is left to the section foreman. In employing new men, it has been found most essential to teach foremen to select men who are physically fit and that they should look for qualifications in men which will make them safe workmen and potential foremen or supervisors. This, of course, applies particularly to regular section men, but in some instances it has been found most advantageous also to have all extra gang laborers undergo a general physical examination for this eliminates men who may have physical defects, such as defective sight or hearing, which would prevent them from being safe workmen.

When new men enter the service, they should be thoroughly tutored in safety and impressed with the need for practicing safety at all times as their first duty. If safety rules are in existence on their railroad they should be impressed with the fact that strict observance of such rules is required. First impressions are most lasting, and too much stress cannot be placed on the careful training of new men. One who is found to be indifferent to these teachings should be removed from the service, both to protect him from being injured or being responsible for an injury to a fellow worker, and to impress on the remainder of the gang that safe men are essential factors in carrying on a day's work.

The Roadmaster Should Observe the Operations of His Gangs From Time to Time to See That Safe Methods and Practices Are Being Employed

Must Use Salesmanship

Thus, if new men are to be properly impressed with the importance of safety, supervisors must be salesmen of a high order, and only those who are thoroughly convinced of the importance of the safety movement may be expected to sell the idea to others. This salesmanship might be simplified if he were dealing with the same type of man in each case. Since this is not true, he must study each case and then formulate methods, which his experience has taught him, for handling the different types.

After men have been well tutored in the first principles of safety, it is necessary that supervision be continuous. If they find that supervision is lax and they are permitted to violate safe practices, it is only natural for them to grow careless and completely forget their early training. Supervisors must be ever on the alert to detect these symptoms and take steps to correct such faults, before the man forms the impression that the supervisor is unmindful of his every act, and is negligent in requiring that good and safe practices be observed at all times.

Since it is generally true that new men are inclined to watch the habits of older men in the service, it is of

paramount importance that the experienced men be given this same supervision. This is necessary, not only from the standpoint of new men, since experience, as well as past safety records, had proven that many experienced men have been injured, and investigation has pointed out that men long in the service become injured by reason of working too mechanically and getting the impression they are immune from injury.

Tact Necessary

Supervision should not be hard and abusive, although it should be firm, and friendly; men should be made to feel that the supervisor is their friend rather than to acquire the impression that he is merely looking for a chance to criticize. Good work should be commended as quickly as poor work is criticised. A supervisor should never correct a man for doing something wrong without telling him how it should be done correctly, for otherwise he may leave the man at fault confused or resentful.

Supervisors should stress the importance of teaming their men so as to gain the best results. Congenial men should be teamed together. New men can be taught the different phases of the work by working with someone who is considered a good trackman and a safe workman.

Safety rules are a very necessary part of safety work. These rules should be of a general nature or be designed to apply to such tasks that experience has shown to be most productive of accidents resulting in personal injury. It must be understood, however, that it would be almost impossible to create a safety rule for every motion on the part of an employee. Too much emphasis should not be placed on these rules, because of the tendency to divert the attention of the employee from the basic concept of the safety program, which is to maintain at all times a consciousness of the necessity for acting safely. In other words, if the employee is to be a safe worker, he must be guided not only by safety rules but by a realization of the need for conducting himself at all times in such a manner as to insure safety to himself and his co-workers.

Diplomacy is necessary in the enforcement of these rules. They should not be used as a club over the employee for purposes of discipline. The worker should be convinced that safety rules are nothing more than suggestions and have been prepared primarily for his own and his fellow workers' protection as well as for the protection of his family and his loved ones. There has never yet been an injury to an employee that did not in some way cause his immediate family much discomfort. Violation of safety suggestions carries its own penalty, while violation of rules usually must be followed by discipline. Of course, if employees persist in the violation of these rules or suggestions discipline must follow.

Safety Recommendations

Get track men interested in the safety movement by having them turn in recommendations which will tend to correct unsafe conditions. These men, in their daily trips over their sections, come in contact with conditions which might be missed by the roadmaster or other officers. Usually these recommendations can be acted upon and the unsafe condition corrected by a very small expenditure. The moral effect on the employee, by the management's action on his suggestion, goes a long way in keeping up his interest in safety matters.

Foremen Should Instruct Their Men in Safe Methods, and Call Attention Immediately to Any Violation of Safe Practices

Safety instructions issued by the roadmaster or supervisor should be clear, complete, concise and interesting. This is most essential for he cannot expect safe and intelligent co-operation from his men until they have a clear understanding of what he wants them to do. He must be patient in giving these instructions, for it must be remembered that the foreman and men, some with limited education and experience, may not be as quick to grasp the full meaning of the instructions as might be expected at first.

Daily Lesson Essential

In his personal contact with his trackmen, the roadmaster or supervisor should always leave some safety message with them. Safety, food and work are essential to a happy well-rounded life, and we cannot expect our men to be safe all of their lives because they have listened to one safety lesson, any more than they can be expected to stay well nourished because they have eaten one good meal. They must have their food and safety daily. It is the foreman's responsibility to be sure that his men get their daily safety lessons.

One of the most vital duties of a roadmaster, division engineer, safety supervisor or other officer is to be constantly on the alert for symptoms of an impending accident, and when these are found immediate steps should be taken to eliminate the causes before the accident can happen. If this can be accomplished we will have succeeded, in great measure, in getting started toward that long-looked-for perfect safety record.

Safety Meetings

Safety meetings are a necessary part of all safety work. The type and frequency of these meetings are a problem for each railroad to decide for itself. Some good results have been obtained from short daily safety talks by each section gang during the lunch period. Others have each section gang hold a short ten minute safety meeting on Monday morning of each week, where events of the previous week are discussed, safety rules are gone over, and safety bulletins are read and discussed, together with any other safety matters which have come up since the last meeting. A safety lesson for the coming week is also read and discussed. Minutes of these meetings are prepared and are forwarded to their immediate superior officer.

In addition to these daily or weekly meetings, larger safety meetings, to which are invited all foremen and trackmen, have been found most beneficial. These meetings are conducted by the general officers and safety supervisor at some centrally located point, it being necessary in some instances to hold more than one of these meetings at different locations in order to take in the men from all locations. After the regu-

lar safety discussions and statistics are presented by the officers, the trackmen are asked to present any safety matters or suggestions they may have in mind. This type of round-table discussion has a very interesting effect on the trackmen, because they know that they have had a personal part in the meeting. In some cases these meetings are held once a month, or every two months and in some cases as seldom as twice a year,—once in the spring, at the start of the season's work, and again in the fall of the year, just before winter sets in.

Safety Bulletins

In order to acquaint every one with the safety news and personal injuries on the entire system, it has been found a good policy to issue safety bulletins. These bulletins should contain rankings of all operating divisions as to the number of reportable injuries based on the million-man-hours worked. A list of all reportable injuries should also be presented, by departments, with a short summary of the cause, responsibility for the accident, and a remedy to avoid repetition. These bulletins may be issued monthly, every other month or as often as is deemed advisable. They may also be issued in the form of a "News Letter" which would also contain other interesting safety news, as well as a list of the most important non-reportable injuries which have occurred, with a summary of their causes and remedies for future prevention.

Track Tools

Proper track tools and their proper uses comprise one method of teaching trackmen safety. Almost all trackmen are now provided with good and proper tools for doing the work at hand. Roadmasters and foremen should teach their trackmen to use the proper tool in its proper place. We would not use a lining bar or a claw bar to tamp a track tie; therefore why should we permit a track shovel, a stone fork, a tamping pick or a tamping bar to be used for nipping up ties or lining track. Many accidents and personal injuries have occurred from such improper usages. Show the men, personally, the proper tool for the proper task, and then insist that they use the tool in the proper manner for that job.

Trackmen should also be taught to refuse to use a bad-order tool. A tool which becomes unsafe while in use should be plainly marked and taken out of service until repaired or scrapped and replaced with a new one.

Visits by Officers

All trackmen are prompt to notice the interest that officers show in safety work. Periodic safety visits by the division engineer, superintendent or safety supervisor are, therefore, recommended. These visits on the job may be brief but they have the desired results in keeping the men alert and safety conscious at all times.

Railway Officers Should Always Set An Example in Safe Practices When About the Track

Investigate All Accidents

As a rule men do not like to be investigated and most particularly after an accident has happened. Therefore all accidents should be investigated immediately by the roadmaster and safety supervisor, or others, depending on the seriousness of the accident, in order to determine what caused it, who was responsible and a possible remedy. This personal interest on the part of the officers will tend to make the parties at fault do everything in their power to avoid another investigation for a similar or other cause in the future.

Committee—F. E. Schaumburg (chairman), rdm., C. & N. W., West Chicago, Ill.; G. M. O'Rourke (vice-chairman), dist. engr., I. C., Chicago; J. G. Gilley, supv., C. & O., Martin, Ky.; H. W. Stenson, gen. supv. m. of w., Me. Central, Portland, Me.; T. N. Turner, rdm., M. P., Newport, Ark.; C. R. Schoenfield, rdm., C. B. & Q., Aurora, Ill.; G. P. Palmer, engr. maint. and const., B. & O. C. T., Chicago; G. L. Griggs, rdm., C. B. & Q., Hannibal, Mo.; Jack Stewart, rdm., S. P., Phoenix, Ariz.; J. T. Cothran, supv., Southern, Batesburg, S. C.; M. R. Palmer, rdm., A. T. & S. F., Las Vegas, N. M.; A. Chinn, chf. engr., Alton, Chicago; G. E. Boyd, asso. ed., *Railway Engineering and Maintenance*, Chicago; C. D. Parker, supv., L. & N. E., Pen Argyl, Pa.; B. E. Haley, gen. rdm., A. C. L., Lakeland, Fla.; C. W. Baldridge, asst. engr., A. T. & S. F., Chicago; R. L. Fox, supv. b. & b., Southern, Richmond, Va.

Discussion

A. Chinn (Alton) stated that in the early days of the safety movement, the development of safe practices and the formulation of safety rules were the principal activities in safety education. He emphasized, however, that we have now reached a stage where education should be in safety principles rather than in safe practices. "I have been particularly impressed," he said, "by the fact that up to six or seven years ago we were making considerable progress in the reduction of accidents in the maintenance of way department. During the last six or seven years, however, we have made very little reduction, and are only about holding our own so far as the number of personal injuries is concerned. I believe that there is something lacking in our methods of education. From a study of the statistics and contact with gangs in which accidents have occurred, I have come to the conclusion that our present educational system has about reached the limit of what can be done in routine work of instruction in safe practices. The trouble seems to be that men do not think, and that future educational work should be so organized as to lead men to think rather than do things by rote." G. L. Sitton (Southern) emphasized what Mr. Chinn said about the future of educational work in safety, and also emphasized the fact that this type of education must be a continuous process. He believed that much more attention should be paid to minor accidents, and that it is desirable in every accident for the supervisor to bring the foreman in to his office for a formal investigation which should be taken down in writing. This will not only impress the foreman with the seriousness of even small accidents, but will lead him to believe that his superior officers are deeply concerned with respect to the occurrence of accidents.

W. H. Sparks (C. & O.) was also of the opinion that most accidents occur by reason of men failing to think. He also believed that much laxity in safety practices results from the fact that railway officers do not always practice what they preach with respect to safety. When men observe that their officers do not observe safety rules, it is quite likely that they themselves will become lax in their observance of them. In other words, it was his belief that

the observance of safety rules should begin at the top.

C. W. Baldridge (A.T. & S.F.) said that safety supervision calls for a high order of diplomacy. He believed that the term safety rules should be changed to that of safe practices, and that every effort should be made to impress upon the men that the safety movement is for their own benefit. He suggested that safety education should not end with matters pertaining to railway work, but that it should include all other practices when away from duty.

President Frame urged roadmasters to always be alert to remove the cause of accidents before they happen, and said that this can be done if the roadmaster is also alert to observe unsafe practices and to discuss matters with the foremen and the men as soon as he observes any violation of safety principles. He said that on his road he had never been very successful in getting laborers to learn safety rules and that they had found it a good practice for the foreman to talk to a man every time he is discovered doing something in an unsafe way, doing this at the time he observes the unsafe action. The foreman's discussion should not be critical, but should be along helpful lines to show the man the safe way of doing his work, without quoting safety rules. J. L. Smith (C.B. & Q.) told of a trip which a superintendent of safety of his road had made over his division with him. He said that it had come to be expected that the roadmaster would talk safety whenever he was with a gang, but that the fact that the superintendent of safety, an officer with whom the men had seldom come in direct contact, stopped and gave a talk on safety seemed to be very impressive to the men, and that he had observed considerable more interest in the subject subsequent to this trip.

The discussion then turned to safety campaigns and the investigation of accidents, and a number of members explained the methods employed on their respective roads in both investigations and safety work.

The Elimination of Train Derailments Resulting from Track Defects

Report of Committee

A. B. Hillman
Chairman

TO eliminate train derailments resulting from track defects we must first locate the defects and then find means of correcting the trouble, in order to prevent future derailments from the same causes. It is only by removing the defects that safe operation of trains can be assured. To do this two basic considerations must prevail, i.e. competent supervision and inspection, and a reasonably adequate standard of maintenance.

Supervision is the least expensive consideration in maintenance. Good supervision pays handsome dividends; it starts with the head of the department and is carried right on down to the person commonly referred to as track inspector or track walker. The head of the department, or the person charged with the responsibility for the safe operation of trains, should be thoroughly versed in maintenance matters, temperamentally suited to discharging responsibilities of such a nature, and be endowed with such a personality as to be able to educate his subordinates and foster in them a spirit of co-operation and efficiency, to the end that each employee will take a personal interest in his particular maintenance job.

The relation of supervision to the elimination of train derailments resulting from track defects must be regarded with the same enthusiasm as some of us have attacked the elimination of personal injuries. Any maintenance condition that may contribute in any way to a derailment, if not be responsible for it, must first be found. Alert supervision and inspection will develop this. It must then be corrected immediately. One must almost be a pessimist when charged with such responsibilities, for all defects must be regarded with respect to the worst that can happen as a result of such an existing condition.

After the track defect has been found and its effect on the safe operation of trains properly appraised, its correction must be of first consideration. It is here that we encounter the condition over which we seldom have any control. Present day economic conditions are and have been such as to be reflected greatly, if not disastrously, in our maintenance programs.

Although it must be recognized that a high standard of maintenance is essential to the elimination of train derailments resulting from track conditions, we must recognize also that the vast majority of these derailments result from the so called small things. Experience has proved that of the many derailments charged and assigned to track defects, only a comparatively few are of such a nature that they could not have been avoided by even a few man hours and a little material.

Investigation of derailments must be free and open-mindedly prosecuted to the end that the real cause is determined, and confined if possible to the one predominating cause. If all departments interested approach this task of assigning the cause for a derailment with the ultimate purpose of determining the true cause, rather than approaching the question from a defensive point of view as relates to their own departments, more satisfactory results can be obtained and ultimately will be of most benefit to the management.

In reporting derailments, a result of the derailment is very often given as a cause and the real cause is apt to be overlooked. For instance, it is quite common to say, "Wheels climbed rail," or "Wheels picked switch point," when what we are after is the condition that existed to cause the wheels to do these things and how to eliminate future derailments of this type.

There are a number of faulty track conditions which will not cause derailments under normal conditions but which, under certain circumstances, coupled with mechanical defects, will derail a car. A casual inspection of the track will disclose no defect but a close examination will reveal the trouble. A slightly low joint or a small irregularity in elevation on a curve, coupled with a stiff truck or a sudden jolt of a train, may cause derailments when the wheels of a car are at this particular spot. Combinations, however, can-

For High-Speed Trains, the Alinement and Elevation Must Be Kept to the Standards Established for Each Curve

not involve track defects unless such defects exist. The only safe plan then to pursue is to detect and to completely eliminate all such defects, no matter how small they may be.

I.C.C. Report Cited

While defects of this nature may seem trivial to the average track foreman, they should, never-the-less, be corrected or they will be partly responsible for expensive derailments. The following is quoted from an Interstate Commerce Commission investigation covering a derailment in which 1 person was killed and 1 injured. "Conclusions: It is believed that this accident was caused by the wheels of a tank car climbing the outside rail of a curve because of excessive side-bearing clearance and irregularities in track surface, the car trucks being held rigid due to the brakes being applied when this car approached and entered upon this curve." The report further states, "The superelevation appeared to be ample for the curve in question. For a distance of 20 rail lengths extending north of the point of derailment, the cross levels varied from 4½ to 5½ in. The greatest variation from one rail joint to an adjacent joint was on the outside of the curve in the ninth rail north of the point of derailment. This variation was 1 in. The gage was not more than ⅝ in. in excess of the standard gage and the rails were only slightly curve worn."

Common Defects

The elimination of train derailments resulting from track defects can best be studied by listing the various defects and then determine the method of correcting them.

1. Irregular or insufficient elevation or improper alignment around curves.

Above is quoted from a report of the Interstate Commerce Commission covering a derailment where irregular elevation was a contributing factor. Slight variations in elevation or alignment on curves which cannot be considered dangerous for low speeds will decrease the margin of safety rapidly as speeds increase. For high speed trains it is essential that the alinement and elevation be kept to the standards established for each curve.

Ballast and drainage must be such that curves can be held to these standards. Frequent, thorough inspections should be made and any adjustments necessary should be made at once. If there is any doubt as to the safety of a curve, the only safe course should be taken and a slow order placed until the condition is remedied. Slow orders are very undesirable from an operating point of view, but never-the-less may be the only sure method of preventing disaster when defects are such that they cannot be corrected promptly.

2. Low joints.—Low Joints will cause sway of cars, which is not only uncomfortable to passengers but is apt to cause a derailment when they occur over a stretch of track and allow the sway to become excessive. The joint is the weakest part of the track structure and considerable headway has been made in eliminating or reducing joint maintenance expense. The various methods for eliminating low joints comprise too large a study to be included in this report. Let it suffice to say that low joints are very undesirable and should not be allowed to exist for the sake of safety.

There is a condition that will cause derailments in freight yards which should be brought to the attention of the track man. A low joint just ahead of a switch will, under certain conditions when a car is making a facing move, lift the wheels and cause the car to climb the switch point on the curve side. Very often this factor is overlooked in making an investigation of the derailment. The switch will be in good condition and the car blamed for the trouble. Eliminate low joints just ahead of switches and this type of derailment will cease.

3. Tight or wide gage.—Tight gage gives little concern on main tracks. In yards it will occur in the vicinity of frogs when the majority of the movements are in a trailing direction and tracks are insufficiently anchored. Even here it is a slow process and can readily be seen by wear on the side of the frog point. The condition should be corrected before it becomes severe enough to allow wheels to split the frog. In checking the gage of frogs it must be borne in mind that the proper gage of guard rails is also of vital importance.

Wide gage is encountered on secondary tracks where the standard of maintenance is not as high as elsewhere. Even in these tracks there is no excuse for such a condition. Wide gage is easily observed by eye and when not corrected before it becomes dangerous, is an indication of a poor track man.

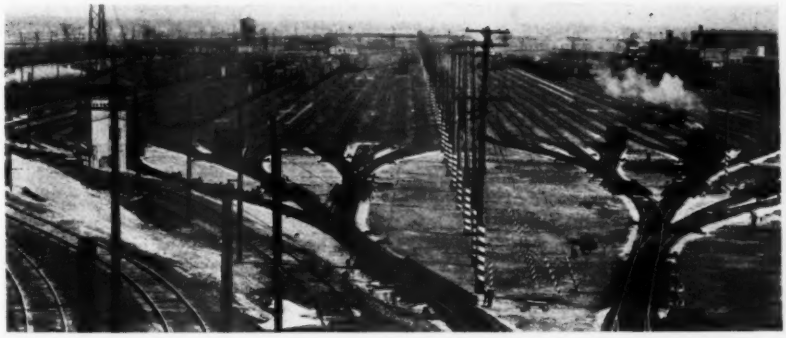
4. Spread Track.—At times, spread track causes derailments through no fault of the section foreman. Power and equipment have rapidly become larger and heavier and speed of operation has greatly increased during a period when maintenance has of necessity been curtailed. It can be readily appreciated that we have reached a critical point with reference to our track structure. For this reason, track defects that have been held responsible for derailments were largely due to the fact that we have not been able to keep the track structure in pace with operation.

Derailments from spread track can generally be attributed to the above. In tracks of sharp curvature, constructed of light material, where it is not advisable or financially possible to increase the weight of ma-

terial or change alignment, a great deal can be done to prevent trouble by keeping the track in the best possible condition with the material available, and by the use of anti-spread rods to hold the rails to gage. It is of the utmost importance that tracks of this nature have sound ties and good tie plates.

5. Broken rails resulting from fissures.—Regular inspection with a transverse fissure detector car is probably the only means of combatting this cause. Fissured rails, when detected, should be changed out as the only sure means of preventing breakage of rail. These rails should be given a distinctive marking to prevent them from again being used in main line tracks. A record of heat numbers should be kept up to date in order that the rails of any heat can be carefully watched or even removed from track if it is found that an excessive number of fissures occur in that particular heat.

Some roads make a periodic "hammer test" of rails in highway crossings in such tracks as are not normally tested with the detector car, such as running tracks, important sidings and heavily-used yard tracks. Using an ordinary machinists ballpein hammer and striking the head of the rail at uniform intervals and with uniform blows, any variation in the sound or ring of the rail is noted. Rails with a cracked base or web can be detected in this manner and removed before derailment occurs. Defective rails in highway crossings are difficult to locate, more especially when the defect is not visible in the head.



Derailments in Yards May Cost Many Times in Damages and Delays the Means of Preventing Them

6. Broken rails resulting from worn or light rail.—Here again the detector car will help. Also a close inspection by the foreman of light and worn rails will disclose a defective rail before it actually becomes unsafe. Split heads and fillet cracks can be easily seen before the danger point is reached. When the entire track consists of worn or light rail, it should be replaced with heavier rail before operation over it becomes a hazard.

7. Broken angle bars.—This is a condition easily seen by the foreman but often overlooked. One bar may be broken and the other sound. When the break is at the rail end, there is a possibility of the other bar breaking under traffic, due to the added stress placed upon it. The sure way to eliminate derailments from this cause is to replace at once any bar that becomes broken, whether the break occurs at the rail end or elsewhere in the bar.

8. Lip on joint.—This is generally caused by loose bolts, a very undesirable track condition. Keep all bolts tight. Also when replacing single rails in track, make sure that they match with rails on either side. If a curve-worn rail is removed from tracks for any cause it should be replaced by a rail as nearly curve worn as possible.

Derailments Under Any Circumstances Are Costly, and Can Be Minimized Only by Close Attention to Details

9. Lugs on switch stands breaking under traffic.—Many yard stands are equipped with breakable lugs to eliminate damage to the switch when run through. They serve this purpose very well as it is only necessary in such cases to turn the lug to another finger at very little expense.

When an engine or car runs through a switch so equipped, however, it is done so easily and quietly that the crew often does not realize what has been done and starts a facing move over the switch, with derailment resulting. Then too, a locomotive will often trail onto the points far enough to place a severe strain on the lug without breaking it at the time. The result is that the weakened lug may break under traffic on a facing move.

While this type of derailment may not be considered as due to a track defect, never-the-less the operating department will class it as such and a strained lug remaining in service is a defect. In some cases the trouble has been overcome by replacing all breakable lugs with non-breakable ones. When a switch so equipped is run through, the track damage is greater, but no doubt is left as to what has happened to the switch and the crew knows at once what has occurred. As a result, facing moves are not made against a switch that has been run through, eliminating a number of costly derailments. The most satisfactory method of correcting defects of this nature is to install safety type switch stands that can be run through without damage to the track or equipment.

10. Kinked track.—There have been a number of derailments attributed to kinked track in which various causes have been responsible for the kinking. To prevent such defects occuring through acts of nature, be certain that the track is sufficiently anchored and that the ballast is ample to hold the track in place under all weather conditions which may occur.

To prevent derailments from these defects when track is being worked over, do not raise the track too far out of its bed in hot weather for the purpose of renewing ties or surfacing and be certain that the work is properly protected by flag and slow order. Do not leave track that is in service skeletonized for any dis-

tance or for any length of time.

11. Split switches.—Breakable lugs, which have been considered separately, comprise a defect that will allow wheels to split a switch. There are various other defects, however, that will also cause derailments from this cause, such as switch points out of adjustment, insufficient housing of points, transit clips breaking, head rods breaking or becoming loose, broken switch stand, and hard throwing switches. Another condition that will cause derailments and is sometimes overlooked is excessive play between the rail braces and the stock rail at the point of the switch. This will permit points to open sufficiently to allow wheels to split the switch, especially when the turnout is on a curve with wheels binding on the high side.

The periodic inspection of switches and the prompt adjustment of any parts found at fault comprise the only sure method of preventing derailments from these defects. It is important that standard gage be maintained at the points and that rail braces fit tightly against the stock rail. The use of adjustable braces, switch point protectors and anti-spread rods are of great value. To help overcome hard-throwing switches, the stand and slide plates should be oiled regularly.

The reason for clips breaking is that the points may creep or ties shift until part of the clip rests on a switch plate. In time, heavy loads passing over the point will break the clip. Correct such conditions by spacing ties before the clip gets too great a bearing on the plate.

When heavily-used switches are run through, the switch stand, even if it shows no defects in the field, should be changed out and the old stand should be thoroughly inspected to ascertain whether it has been subjected to a strain which might have allowed it to break under traffic if it had remained in service.

12. Climbing switch points.—In yard layouts, engines will often climb the switch point for no apparent reason. A casual inspection and sometimes a detailed inspection will fail to find a satisfactory reason for the derailment.

Wear on the point is no doubt the chief cause for this type of derailment. There is no set rule which sets forth the amount of wear a point can have before it becomes unsafe. This is something that must be left to the judgment of the supervisor. Naturally, points are retained in service as long as possible in order to get the maximum life out of material. To leave a point in the track until it causes a derailment is not economical, however, and when its safety becomes questionable, it should either be removed from track or restored by welding. Points should also be held rigid by stops or by other means in order to keep them from twisting in under wheel loads.

Turnouts on the inside of sharp curves should have guard rail protection for the high side point. A guard on the inside of the rail, ahead of the point, while helpful, is not entirely satisfactory. Such a guard must of necessity end just ahead of the point and wheels which have been pulled toward the inside of the curve by the guard, force themselves back against the point on the curved side. Switch point guards placed on the outside of the rail have proved satisfactory in these cases. Some railroads have solved this problem successfully by increasing the length of the outside point, thereby making the guard rail more effective.

Complicated Track Layouts at Busy Terminals Demand Daily Attention and the Use of High Grade Materials

The installation of rail and flange lubricators will do much toward reducing wear on points on the high side, thereby not only decreasing the danger of derailment but also decreasing maintenance costs.

There are many defects that are overlooked by some foremen and it is necessary for the supervisor or roadmaster, with his greater knowledge of track conditions, to instruct and educate these foremen so that they will see these defects and remedy them promptly. One thing which should be impressed on the foreman is the necessity of keeping the flangeways of highway crossings free from dirt or other obstructions. In the present day of high speeds an obstruction in the flangeway can have very disastrous results.

Derailments over which the foreman has no control are caused by heavy power and faster speeds on tracks that are entirely inadequate for such purposes. Possibly this kind of derailment cannot be attributed to track defects. We cannot overlook the fact, however, that they are caused as the result of a track condition.

The increase in size and weight of power and equipment, the increase in speed, coupled with the fact that small power is fast becoming obsolete and that railroad managements desire any type of equipment to travel over all tracks, make this one of the most important and costly problems the track man has to face. Under the adverse conditions existing during the last seven or eight years, the track man is to be highly commended for having surmounted all obstacles in keeping the railroads safe for operation.

Committee—A. B. Hillman (chairman), rdm., Belt Ry., Chicago; J. M. Miller, (vice-chairman), div. engr. m. of w., Cumberland, Md.; D. E. Lynch, rdm., C. B. & Q., Sheridan, Wyo.; O. R. McIlhenny, rdm., T. C. I. & R., Birmingham, Ala.; T. F. Donahoe, supvr. B. & O., Pittsburgh, Pa.; C. W. Ayling, rdm., A. T. & S. F., Chanute, Kan.; J. N. Woodell, rdm., A. C. L., Jacksonville, Fla.; H. C. Fox, supvr., Southern, Emporia, Va.; J. J. Van Bockern, rdm., C. M. St. P. & P., Savannah, Ill.; J. L. Hamilton, div. engr., Soo Line, Minneapolis, Minn.; R. C. Hager, supvr., N. Y. C., Kentland, Ind.; J. C. Jones, rdm., C. P., Regina, Sask.; J. T. Stotler, rdm., N. P., Helena, Mont.; W. M. Anderson, rdm., S. A. L., Birmingham, Ala.; M. W. Johnson, rdm., Ill. Term., Alton, Ill.; F. C. Hajek, rdm., C. & N. W., Wall Lake, Iowa.

Discussion

Considerable discussion arose concerning the advisability of educating young supervisors with respect to track defects that are likely to cause derailments and with respect to mechanical defects which have the same result, and particularly with respect to combinations of track and mechanical defects that are likely to cause derailments. While no evidence was presented that such educational methods have been used, a number of the members thought highly of the suggestion.

During the discussion, a number of instances were mentioned of derailments that had been caused

either by mechanical defects or by a combination of mechanical and track defects, and of the methods that were employed to avoid further derailments from the same causes. W. H. Sparks (C. & O.) stated that, in general, track is now constructed to so high a standard that few derailments should occur by reason of track defects. President Frame agreed that higher standards of track construction have done much to prevent derailments, but stated that higher standards of construction cannot overcome neglected maintenance, and that, in general, neglected maintenance is the cause of derailments that occur by reason of track defects. Under these conditions derailments are particularly likely to occur in combination with mechanical defects. "For these reasons," he said, "care should be exercised to remove border line cases as well as serious defects."

The question also arose as to the advisability of repairing switch points by welding. It was generally agreed that welding is satisfactory if the welded switch point is placed against a full headed rail, but if placed against worn stock rails, the welded point is quite likely to break.

The Programming of Track Work

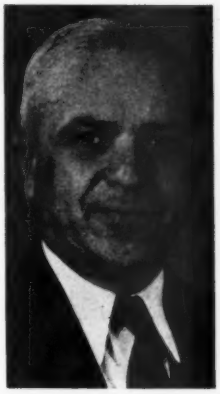
Report of Committee

THE word programming, when applied to track work, has two quite definite meanings. One is the programming of various classes of work in advance so that all concerned will know what work is to be done during a certain year or other period. The other is the planning of different classes of work for definite seasons of the year, setting up a time when each class of work can be done most economically and safely with the most lasting results.

All railroads and all maintenance officers do some of both classes of programming. It is well known that successful maintenance requires planning in advance, and the performance of various classes of work at the proper season of the year. On some railroads, more extensive programming is conducted than on others. The programming of track work is good business and, generally speaking, the more thoroughly it is done, the better. Any foreman will get more work done if he knows how much money he is expected to spend, and if he knows that the quantity and unit cost of his work are going to be checked by his supervisor and that he will have to explain why he did not do a certain class of work as economically as some other foreman.

Practice Will Vary

The careful and efficient programming of track work is vital to the safe and economical operation of our railroads. On account of climatic conditions and other governing factors, programming of this work will vary to a very great extent for different parts of the country, but in preparing this report the committee has endeavored to take a cross-section of the railroads as a whole, and make such recommendations or suggestions as will apply to a number of representative railroads.



S. J. Hale
Chairman

In securing the necessary information for preparing a carefully worked-out budget, the supervisors should discuss their contemplated work with the maintenance engineer, and before making recommendations, should make a trip by motor car over their territories with the maintenance engineer, accompanied by the section foremen over their respective sections. The need for work of various kinds should be gone over carefully on this trip, and this work should then be summarized, and recommendations made for divisions as a whole. These recommendations should include the renewal of rail and fastenings, ties, and the amount of track to be surfaced, with the necessary ditching, building of roadbed, etc. The district engineer should carefully analyze all recommendations, and, in turn, forward them to the engineer maintenance of way. The engineer of maintenance of way should compile and consolidate those repairs that may be necessary and present them to the management for approval, carefully outlining the requirements for each item.

Maintenance of Way Allotment

It is of paramount importance that a definite sum for maintenance expenditures be alloted prior to the beginning of the work year. The amount of this proposed expenditure should be determined and based upon the results of a personal inspection of the property by the chief maintenance officer and his subordinates. This inspection will indicate the necessity for major work to be performed, such as new and relay rail, ties, ballast, rail end and frog and switch welding and such roadway work as ditching, banking, cleaning and mowing.

After the budget is distributed to the divisions, the division engineers should in turn distribute the amounts allowed them for various classes of work among their supervisors, who should in turn go over the individual sections with the section foremen, and thoroughly discuss the work contemplated on each section and develop a schedule to be followed; although no matter how well the maintenance budget may be prepared, it cannot be followed literally, but it can be used as a guide, and will be very helpful in securing better maintenance conditions with more uniformity and higher efficiency.

It is very important that periodic inspections and reports be made to insure that the program will be carried out as established. Simple but complete progress reports, posted currently at division headquarters will indicate if this is being done.

Regular section allowances should be made on a monthly basis. The amounts should be based on the recommendations of the roadmaster, and checked by the chief maintenance officer, who should determine the amount

of the expenditures necessary for the coming month, giving consideration to the needs as compared to the earnings, and which should be handled directly under the supervision of the roadmaster. The roadmaster should be allowed a definite number of section foremen and section laborers for the month, and he should in turn allot the men to each foremen as he may deem necessary to keep up their sections for that month.

Advantages of Programming

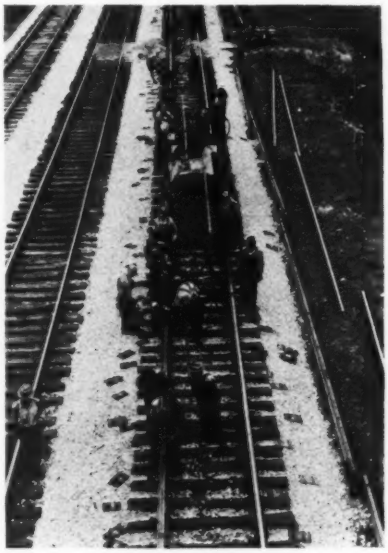
The management and economical expenditure of funds require the preparation of a budget. It has long been recognized in industry that uniformity in volume of work and continuous operations are essential to maximum efficiency, and that the cost of work increases directly as these factors decrease. From this statement may be developed the fact that lack of uniformity and continuity produces a greater labor turnover, which invariably results in less efficient work, greater cost per unit of work performed, and a lessened element of safety for the men doing the work.

The programming of all major maintenance work such as new and relay rail, ties and ballasting, that can be so scheduled, is now all the more necessary since many railroads have during recent years invested great sums in mechanical equipment with highly organized mechanized gangs. The return on this investment varies directly with the use which is made of the equipment. The more days that a machine is used, the less is the unit cost of owning the equipment; hence, the necessity of keeping the machinery in use.

It is of extreme importance and value that we consider co-ordinating several interrelated maintenance operations. Welding rail ends and tightening bolts occur to us as two items, the programming of which should be closely coordinated with plans for laying new rail and surfacing track. It would, of course, be wasteful to do this work on rail which will be replaced in a reasonably short time. Ties should not be dug in where track is to be surfaced, or ballast cleaned where later ditching or roadbed operations will interfere.

Necessity For Programming

The programming of track work is very essential from several angles. We may first consider the efficiency of a well organized force, which is closely related to cost and safety. Where a road has regular organized gangs, either mechanized forces or regular section forces, it will get better results at less cost than it will from ordinary floating gangs, and during the present condition of the railroads, the management is expecting supervisors to do their work as cheaply as possible, which cost will no doubt be a governing factor in the amount of maintenance work allotted.



Rail Renewals Must Be Programmed in Order to Utilize Equipment and Men Most Effectively

Also, the more efficiently that work is done, the less interference we create for traffic, which is of vital importance.

Time Schedules

After the various work items have been approved by the chief maintenance officer, the roadmaster should make a careful study of the work he is to perform, determine what material, as well as forces, he is to receive, and work out a definite and well-arranged program where different materials will be used. He should also determine the time that the material should be distributed and to what point it should be shipped and unloaded, as well as the method to be used in unloading it.

The roadmaster and maintenance engineer should cooperate in formulating programs and budgets for maintenance work, and they should benefit largely from their experience, and from the practice of others in the same class of work. It is very difficult to formulate an iron-clad program of budget allotment that will be applicable in all cases owing to climatic conditions, policies of the different carriers, and the constant changes in economic conditions. However, a great deal can be accomplished by careful study and the unrelinquished efforts of every maintenance officer when working out definite maintenance programs.

It is desirable to prepare a maintenance schedule for the year's work in which are set up the units of materials and labor to be used during the coming year. In programming the work during the year, the schedule of the principal items should be as follows:

(1) Laying Rail—Rail should be purchased or contracted for during the preceding year, affording time for it to be delivered and distributed in the early spring well in advance of the rail-laying program. Main line rail-laying should be started in the early spring or as early as weather conditions will permit, and rushed to completion. The program should be arranged so that there will be no unnecessary moving of forces, and the work on each district should be completed while the forces are on the ground. As main line rail renewals are completed, the rail removed from the track should be classified and relayer rail transferred to branch lines or yard tracks for relaying.

(2) Surfacing Track—New rail should be gone over and given a general smoothing as quickly as possible after laying, and as soon as the frost has gone from the ground, it should be given a general surfacing. Track surfacing in general should begin in the spring as early as weather conditions will permit, and the program be so arranged that it will be completed in the early fall before freezing sets in.

(3) Tie Renewals—Where tie renewals are necessary, this should be done in connection with ballasting. Where renewals are to be made in other than ballasting territory, this should be started as soon as the ground thaws out in the spring and completed by late summer, endeavoring to complete all main line and branch line renewals at approximately the same time.

(4) Smoothing and Lining—As soon as practicable after the frost leaves the ground, track should be gone over and given a good smoothing and lining, especially at points where it has been necessary to use shims during the winter, and every possible effort should be made to get the track in good condition before the beginning of regular ballasting and tie renewals. Of course, it is necessary to do a certain amount of this class of work throughout the entire year.

(5) Ditching and Repairing Roadbed—So far as practicable, shoulders should be built up and the roadbed repaired ahead of ballasting. This will

not only give more substantial track, but will reduce the amount of ballast required. All heavy work of ditching and building roadbed should be done with machines, such as ditchers, spreaders, crawler and power shovels, during the winter months of each year. A program should be prepared to cover the lines on which each of these machines will work during the following year. These machines should be moved to various sections over the divisions where weather conditions would not interfere with their work. In other words, these machines should be kept in continuous operation so far as this is practicable.

(6) Mowing Right-Of-Way—Mowing right-of-way should be done at least once yearly. However, in some instances it is highly desirable to do this at least twice yearly. Where it is only done once, it should be mowed during the month of July, and where it is necessary to mow twice, it should be done during June and August. All section forces should start on this work at the same time, endeavoring to get it completed at as nearly the same time as possible, cutting a uniform width throughout.

(7) Miscellaneous Work—Miscellaneous work, such as gaging, settling spikes, and repairs to fences should be carried on throughout the year as may be necessary, and with as little interference with major work as possible.

(8) General Cleaning of Roadway—Once yearly, the roadway should be given a general cleaning, starting about the first of November. This work should consist of getting rid of all dead grass and weeds, and any regrowth which has occurred since cutting of right-of-way, trimming grass close on the inside slopes of cut ditches, cleaning out and lining up the bottom of ditches, filling low places in the roadbed, cutting grass to line, lining ballast margins, opening up cross drains, etc.

Committee—S. J. Hale (chairman), asst. supt., N. & W., Bluefield, W. Va.; G. L. Sitton (vice-chairman), chief engr. m. w., Sou., Charlotte, N. C.; R. L. Sims, dist. engr., C. B. & Q., Galesburg, Ill.; E. L. Banion, rdm., A. T. & S. F., Independence, Kan.; L. E. Thornton, asst. divn. engr., Alton, Bloomington, Ill.; L. L. Smith, rdm., C. B. & Q., Burlington, Iowa; A. G. Reese, rdm., C. & S., Trinidad, Colo.; M. J. Lucy, supvr., D. & H., Plattsburg, N. Y.; C. T. Mulcahy, rdm., S. P., Bakersfield, Cal.; A. R. McEachern, rdm.-trnmast., S. P., Mina, Nev.; W. C. Radford, supvr., Sou., Keysville, Va.; H. E. Kirby, asst. engr., C. & O., Richmond, Va.; N. D. Howard, managing editor, R. E. & M., Chicago; A. W. Wehner, rdm., S. P., Lake Charles, La.; J. D. Sullivan, rdm., C. & N. W., Chicago; C. N. Gilmette, trk. supvr., N. Y. N. H. & H., Cranston, R. I.; T. A. Gregory, rdm., N. P., Fargo, N. D.

Discussion

In the short discussion which followed this report, considerable emphasis was placed on the desirability that division and higher officers should go over every section in enough detail to determine on the ground just what work is needed, and that no definite plans for work should be decided upon without consulting the section foreman, who, it was pointed out, is familiar with the requirements on his section.

The Maintenance of Turnouts

Report of Committee

THERE is a time-honored saying among maintenance of way men that the turnout is the weakest part of the track structure. A considerable proportion of the derailments occur here. These derailments are attributable to the fact that a turnout has more parts to get out of adjustment; moreover, it is subjected to certain stresses that other parts of the track are not called on to resist. For these reasons, it is important that turnouts be watched closely to insure that defects do not develop. This may be brought about by a daily visual examination of each turnout and by a thorough and detailed inspection of their parts at least once a week.

F. J. Liston
Chairman

Location of Rail Joints

It is desirable that the nearest joints should be at least 5 ft. and preferably 6 ft. in advance of the switch points. It is equally desirable that these joints be square if practicable, since this avoids the necessity for placing any joints between the point and the heel of the switch, an objective that is greatly to be desired. Where 39-ft. rails are used, there is no difficulty in obtaining a spacing of 6 ft. between the points and the joints, with points up to 30 ft. Where 33-ft. points are used, there is only 6-ft. difference in the length of the point and the main rail, and this difference should be divided in order to keep all joints outside of the heel and points of the switch.

Loose connecting rods are often the cause of switch points becoming blunt. In many switches there is from ⅛ in. to ½ in. slack in the connecting rod and the head rods, which is usually taken up by the use of a bushing of some kind. This bushing often slips out and allows the point to open to the thickness of the bushing; the wheel then begins to strike the end of the point and it soon becomes blunt and unsafe.

Switch rods and connecting rods should be firmly tightened, cotter keys should be applied to all bolts where so required and placed with the nut up and the cotter pin in view where possible. Worn holes in old rods should be reamed and larger bolts used. Vibration in time wears the mast holes in rigid switch stands and these stands should be repaired through re-bushing.

Yard switches should be watched the same as main line switches, although in many cases material can be used in yards that would not be safe for main lines. Yard lead switches should be watched closely and kept cleaned and oiled, for switchmen will often fail to get a switch closed ahead of the car wheels on account of dirt and lack of oil on the slide plates, causing derailments and damage to the switch to an extent that heavy

repairs are required, resulting in unnecessary expense.

During the winter particular attention must be paid to the removal of snow and ice from between the switch point rails and the stock rails; otherwise the points cannot be drawn to a closed position where they fit snugly against the stock rail. In addition, the icy conditions will raise the switch rails sufficiently to permit the top of the switch point rail reinforcing strap to strike the bottom of the ball of the rail, rendering it impossible to close the point properly until the cause has been removed.

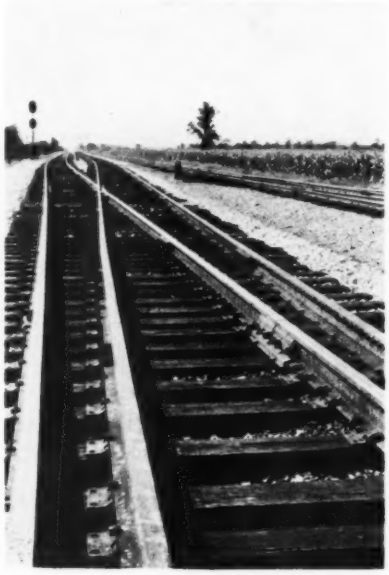
A source of neglect that is less common but probably the most dangerous of all is the failure to replace stock rails when they have worn to the limit of safety. When a stock rail is allowed to wear down, the point becomes high or wears correspondingly. Then if a new stock rail is installed without changing the point a hazard is created.

The ties throughout the length of the switch rail and especially at the heel of the point and beyond the joints ahead of the points should be sound and tamped to an even surface. Deteriorated ties at the heel of the points eventually cause a low joint, even with the heaviest plates, and probably bent angle bars, with the result that the points rise as the wheel strikes the low spots. With first class tie conditions, a teetering effect is sometimes observed and examination shows that it is attributable to high ties somewhere along the length of the points, which shows that all of the slide plates have not been maintained to the same plane in surfacing operations.

Again, rising points have been found attributable to the fact that in the repair of a switch which has been run through, the head and bridle rods and lugs or cuffs are almost always bent. While these rods may be removed and straightened and re-installed in place, the bent lug should not be allowed to remain in service since it will almost certainly cause the points to rise.

Proper Gage Important

When switches are operated from interlocking towers, the responsibility for their adjustment is commonly placed on signal maintainers; when operated by stands, their maintenance is always left to section forces. It is essential in either case that the track be maintained to exact gage. On most main line interlocked switches and on many hand-thrown switches, gage plates are in general use and these not only establish the correct gage but do much to prevent widening. On other switches, especially in yards and in secondary main and branch lines, gage plates are not used and the gage must be brought to exact standard and so maintained. The taking up of lost motion in the rods, due to wear by the insertion of washers between either the switch point lug or the transit clip and the points is poor maintenance. It is equally objectionable to drive a spike in the jaw of the head rod where it is attached to the transit clip or old fashioned switch point lugs. Either of these methods decreases the throw of the points by the thickness of the inserted object, making it possible for a wheel flange to strike the point. Also, spikes or brake shoe keys, when so inserted, may jar out, leaving an objectionable lip on the closed point side.



The Difficulties Presented By Rail Creepage Can Be Overcome By An Adequate Number of Rail Anchors

Care should be taken to see that the lead rails are cut to the exact length specified in the turnout drawings; otherwise, one switch point will lie ahead of the other and the head rod will extend across the track at an angle, causing the wrong throw on one side. In addition, there is a tendency, through creepage of one of the lugs, to bend against the side of the tie, making the switch difficult to throw.

Head blocks should be square across the track; otherwise the throw will be increased on one side and decreased on the other. The drilling of the switch rods should be checked closely, as it has been found that the machinists at shops occasionally err in drilling these rods, causing undue loss of time in efforts to adjust the switches as well as unbalanced adjustment. Switch rods and connecting rods should be kept firmly tightened with jam nuts. Finally, the switch stands should be securely fastened to the head blocks by means of ¾-in. bolts with the nut end up.

Wear of Parts

Where the base castings of rigid switch stands show considerable wear after service, these stands can be reclaimed by truing the mast holes in the castings and fitting them with steel bushings. Spring switches should be tested at intervals for weak springs by inserting a track spike between the point and the stock rail; if the switch handle can then be set down in the locking position, after throwing the point against the object, adjustment must be made to take up the lost motion. In the event of failure to eliminate this condition through adjustment, the springs should be replaced. These stands can be converted into the rigid type by replacing the coil spring with a pipe of the proper length and sufficient flat washers to take up the slack.

While there are no set rules for the vertical limits of wear of the frog point or the wing rails, it is obvious that it falls within the same general practices as are prescribed for rail. Frogs are generally changed out because of batter or breaks long before vertical head wear has become a matter of consideration. Flange wear, however, is encountered more frequently at the heel of the point rail and toe of the wing rails and frogs should be either changed out or built up before the prescribed limits of wear are attained. Flowing metal should be removed from the flangeways periodically to maintain them the standard width.

In spring frogs, wing wheel risers have done much to relieve the thin portion of the frog point of the wheel loads, thus reducing batter and spalling previously experienced at the point of the frogs.

Spring bolts break due to the running of the rail tightening the spring rail in the housings, enabling vibration to wear the bolts, which are held in tension until breakage occurs. Loose hold-down boxes are dangerous, especially at the heel of the frog, because the end of the wing rail has more chance of raising. The creeping of rail and the bending of springs and hold-downs cause the wing rails to remain open. There is no particular danger when a wing rail remains in the open position unless a broken rim of a wheel falls through, as the guard rail protects the movement and the hold-down housings and spring bolt prevent the opening to an extent that

will allow the wheel to fall through.

Where wing rail breakages occur just ahead of or at the frog point, the trouble is sometimes due to the bend of the wing rail leaving a definite mark in the base. The condition of the pipe fillers in the toe block is also sometimes found to be a contributing factor, for it is obvious that when these sleeves or fillers are so worn or are of incorrect length that the operation of the wing rail is limited, considerable strain is being placed on the wing rail near the spring box bolt, ultimately inducing a fracture.

Riveted Construction

Where rivets are used to fasten the base plates, they have a tendency in time to work loose and if not replaced they break or pull through the plates, especially where the heads are counter sunk. Repairs are generally effected in the field by a blacksmith and helper who replace the rivets, the section forces providing such additional assistance and flag protection as are required, the spikes being pulled, the frog raised and the rivets heated and replaced by means of a portable forge and suitable tools. An acetylene torch is sometimes provided to facilitate the removal of the old rivets and bolts before their replacement. In worn holes, oversize rivets should be installed. Rivets in switch points are also replaced when necessary. All frog plates are removed and put back, as well as the loose or missing rivets in the reinforcing straps; missing or broken bolts are replaced and hold-down housings placed in good condition.

Welding, although not widely employed as yet, possesses certain possibilities for eliminating the use of these rivets. Some railways are, however, now making use of plates riveted on with shoulders welded on both sides of the rail. In changing out frogs where the heads of the rails at the toe and heel of the frog are worn down, the rails on each side of the frog should be changed out or rebuilt through welding to make good joints at each end of the frog, for frogs are much more expensive than rails and it is very hard to maintain their surface unless the joints are in good condition.

Large savings have been effected by the reconditioning of frogs in the track and from experience it appears that they can be built up time and time again until they are unfit for service for other reasons. In welding spring frogs in the main line, thorough repairs are effected by the tightening of the bolts and the cutting out and replacing of loose rivets. When welding the wing rail, it is good practice to spike it at the end to keep it from warping.

Frogs can also be repaired in track, a particular advantage attained through this being that it is not necessary to change rails to fit the full section of a new frog, as the rail ends can be built up to meet the conditions. Through welding, the life of the frog can be prolonged until the wear of the rail head and shallow flangeways render it unfit for further service.

Guard rails have only one function, that of preventing the wheels from coming in contact with the frog point. Thus, their design and installation should be such as to allow the wheels to pass through the frog and guard rail with minimum shock to the equipment and the track structure. The initial step in either installation or resetting is to know that the track is in exact gage. The guard rail should be so set that the distance from the gage line of the frog to the wearing side of the guard rail is 4 ft. 6⅝ in. or 4 ft. 6¾ in., regardless of the gage of track. This distance must not be greater, otherwise it may exceed the back-to-back measurement of the wheels and result in damage or derailment.

Guard rails are generally set with the middle point ahead of the frog point, since the protection of the facing point is the main consideration, while the only protection required back of the frog point has as its purpose a reduction of wear on the heel of the frog. The setting in front of the frog is designated on the layout plans and is governed by the length and design of the guard rail.

Guard Rail Gage Important

Indications of wide guard rail gage can be quickly detected by the marks made by the wheels on the running face of the guard rail itself as they come in contact with the wing rail of the frog and by the marked tendency for the spikes holding the frog, the guard rail, or the running rail to become loose. Narrow gage can be detected quickly by wheel flanges striking the point of the frog. Badly-worn guard rails or frogs will cause narrow guard rail gage; battered frogs nearly always cause tight gage. Creeping rails cause variations in the guard rail gage, depending on the severity of the action, while they not infrequently shove the frog out of line with equivalent results.

Too many foremen disregard the plans and still space their guard rails from the running rail to fit the width of their three fingers, rather than to the exact distance from the opposite rail, as indicated on the standard plans. The results attained are not so correct in that they fail to take note of extra width of gage introduced because of curve conditions and generally result in a derailment.

Broken wheel flanges, especially of cast iron, have, in many cases, especially in yard service, caused the finger of suspicion to point to the fact that vertical rail head wear has reached the point where the splice bars, the cast iron and steel strap stops, the nuts at the heel of the switches, the strap or casting at the heel of the switches, the manganese body throat block of frogs, and the cast iron filler blocks at the end and center clamps of guard rails in turnouts of 85-lb. section or lighter are being hit by passing wheels.

Flangeways

New wheels have flanges 1 in. deep which, with a ½-in. limit of wear of the tread, may be 1½ in. deep before being removed from service. The standard flangeway depth required with new 85-lb. rail is 1⅞ in. From these dimensions it is obvious that the maximum permissible limit of vertical head wear to maintain ⅛-in. clearance between the maximum worn wheel and the bottom of the flangeway is ¼ in. Rail of 85-lb. section with more than this ¼-in. vertical head wear should, therefore, be replaced through switches, guard rails and other points of restricted flangeway depth. In the majority of cases, the broken flanges appear to be caused by the cast iron filler blocks in loose guard rails becoming wedged in a cocked position so that they are struck by the wheel flange about ¼ in. up from the outside diameter of the flange, resulting in a crack breaking through to the back of the flange about 4 in. up.

It is frequently found that at times the longer and heavier locomotives raise when rounding the curve in some of the sharp turnouts and climb over the guard rail. While it is the general practice and common opinion that guard rails of height equivalent to that of the running rail are sufficient in properly maintained track where speed regulations are observed, there are cases where the speed regulations are not fully observed and a slightly higher guard on the inside or low rail of the curve has the tendency to decrease the possibility of derailments from the lifting of tender trucks or trucks on an improperly loaded car.

Care should be taken, when installing one-piece guard rails at turnouts on sharp curves, to see that the graduations in the spike slotting are such that the guard rails may be spiked in their proper position without creating any tendency on the part of the track

rail to pull the guard rail out of its proper setting, especially when extra width of gage is to be allowed between the guard rail and the running rail. Section forces may set the guard rails properly and, after driving several spikes, remove their gage and fail to check the guard rail after the completion of the spiking, failing to observe that the guard rail has been drawn away from its proper setting.

In tangent track standard gage is maintained through the main line side of the turnout. On the turnout side, however, the gage varies with the degree of curvature through the turnout. Thus where the curvature is less than 6 deg., standard gage is maintained; where the turnout curvature is from 6 to 9 deg., ⅛ in. extra width is introduced on the turnout side; from 9 to 12 deg., ¼ in. From 12 to 15 deg., ½ in., and from 15 to 20 deg., ¾ in. extra width in gage is allowed. The widening of gage is started from the last heel plate and increased gradually until at a point 10 ft. from this plate the full extra width is attained and then carried through the turnout. When turnouts originate on curved track, the gage is determined by the rule for widening gage on curves, although in the case of a turnout from the inside of a main track curve, the gage of the main track is kept to standard gage throughout the turnout.

The position of the curved lead between the switch and the frog is generally determined by offsets, measured from the gage side of the straight or main track stock rail in accordance with the distances and measurements given on the standard switch layout plans or approved tables. The employment of such measurements eliminates lengthy computation. Where information of this type is not available, one may stretch a cord from the gage line at the heel of the switch point to the gage line at the toe of the frog, the frog and switch rail having been spiked in position. The distance is then measured and divided into four equal parts. From the middle of the cord an offset or ordinate having a length of 6 in. is measured at right angles to the cord, and from each quarter point on the cord an ordinate of 4½ in. is measured. These ordinates give three points in the line of the gage side of the curved lead rail. The same lengths of ordinates are measured for all turnouts, regardless of the frog number.

Rail Anchors

Rail creepage, if unchecked, will quickly distort an entire turnout assembly, throwing it out of line and affecting the gage, particularly at the frog and switch points. The only practicable means of preventing this creepage is by applying rail anchors, varying the number of anchors used and their placement with such factors as whether the turnout is on single or double track, whether it leads to a passing track or to an industrial spur, the speed at which trains are operated through the turnout and whether the loads are equalized in both directions through the turnout. On single track, rail anchors should be applied so that creepage in both directions may be arrested. In double track territory, the rail anchors should be applied in the direction of the traffic for some distance on either side of the turnout.

Winter Conditions Impose Added Burdens and Responsibility on the Track Forces

Every effort should be made to see that the application of rail anchors is balanced, for if an insufficient number of anchors are applied away from the turnout and a surplus through the turnout, the turnout itself must resist the creeping of the main line rails. When the main track away from the turnout is properly anchored, the anchoring of the turnout becomes less difficult, as a general rule, when rail anchors are applied in both directions for 6 or 8 rail lengths on the approaches to a single track turnout and only in the direction of the accumulative creepage on double track. On the turnout side, the anchors should be applied from the heel of the points to the toe of the frog and from the heel of the frog to at least two rail lengths beyond. In the main track side, rail anchors should be placed at regular normal intervals. The exact number to be used varies, as do the conditions affecting each individual turnout. Sufficient anchorage should be applied throughout the turnout to insure that it will be held rigidly against internal movements.

While the same hazard is not involved in yards as on main tracks, it is otherwise just as important to apply rail anchors there as on main lines wherever rail shows a tendency to creep. Usually rail anchors that have been released from main line service are available. In modern yard operations cars move continuously from the receiving end of the yard to the departure end. If rail anchors are not applied on the ladder tracks, through the turnouts and for a reasonable distance back of the frogs, the frogs cannot be held in place and good line and gage maintained through them. The switch points are also affected by the creepage, which in many cases causes them to bind against the head blocks or adjacent ties, making it both difficult to throw them and to maintain them in adjustment, where quick, easy-throwing switches are so important during switching movements.

In less important yards, rail anchors should be applied at locations where cars are kicked into tracks with the brakes practically set up, as the rail invariably moves in the direction of the car movement. Where the switches and tracks are used about as much in one direction as the other, rail anchors cannot be justified for the tendency to creep is about balanced.

Too much care cannot be devoted to the surface through turnouts on tangent track, where movements into the siding are made at slow speed. No elevation is carried in the turnout side where turnouts take off of curves and slow movements are made through the turnout side; the elevation in many cases has been removed through the use of shims or plates of the proper thickness. Where high speed turnouts exist, the switches in general are long and lend themselves readily to the desired speed with a minimum of elevation.

Inspection

The maintenance rules of all railways provide that foremen must personally inspect all switches frequently. One method of inspecting a switch is to start half a rail length ahead of the point rail and check the gage at joints, centers and quarters through the main and turnout side to a point at least one rail length behind the frog, correcting the wide or tight gage found. Similar use should be made of the level board and any uneven surface should be righted.

As derailments at turnouts usually occur at the point of a switch, at the frog point or on the turnout behind the frog, the principal features to observe in making an inspection are that there is no lost motion in the connecting and front rods detected by throwing the switch; that the eye bolt or crank and switch stand mast are not bent; that the cast iron lugs are se-

curely bolted to the point rail and that they are not cracked or broken; that the pins which fasten the rods to these lugs are equipped with cotters and that they are spread sufficiently to prevent them from coming out; that the bolt which fastens the other end of the rod to the arm of the box or to the eyebolt of the stand is also equipped with a cotter properly spread to prevent the nut from backing off; and that the jam nuts on both the connecting and detector rods are screwed up tight against the clevice or jaw nuts. Defective rods or connections should be corrected immediately by track and signal forces, for if neglected they are apt to cause signals to indicate a clear block for trains when a switch is open.

Must Note Many Details

Improperly fitting points and chipping metal should also be noted as wheel flanges usually mount the point and ride across it. Worn stock rails, a blunt or flat spot on the top of the point and a vertical flange form a combination which invariably results in a derailment. To avoid responsibility for such an occurrence, it is apparent that switch points and stock rails should not be left in service when they are worn to the extent that they are not considered safe.

Perfect surface should be maintained for a distance of at least 100 ft. each side of a turnout switch, frog ties should be thoroughly tamped and special attention should be paid to the fit of the joints, on both sides of the frog. Flange wear on the turnout rails between the heel of the switch point and the frog point should not be overlooked. Loose guard rail bolts and sometimes the absence of bolts, leaving the guard rail without support, are responsible for derailments at frogs. Clip bolts, guard rail bolts and frog bolts should be kept in place, for if provision has been made for a bolt in any part of the turnout, the bolt should be there. It is essential that guard rails should be maintained in true gage position to insure safe movement through the frogs and finally the position of the springs and spring bolt of the spring frogs and their tension should be maintained so that the movable rail works freely.

Excessive or uneven elevation behind the heel of the frog and on the tangent on the turnout behind the frog are generally the cause of or at least a contributing factor to most derailments behind the frog. Turnouts, unless they are on the inside of a curve, do not require elevation, at least from the point of switch to a distance of 10 or 15 ft. behind the heel of the frog, and if the elevation is abrupt or too great between this point and the tangent, it throws the locomotive or cars into a twist which, if they happen to be unduly rigid or have worn center bearing truck castings, will cause the wheels to lift over the top of the rail.

Turnout maintenance is becoming more and more subject to exact measurements and dimensions. The extent of the wear of the rail must now be measured more accurately than by ascertaining how it feels when pinched by the finger.

Failure to maintain track and guard rail gage on main line turnouts consistent with the standards reduces efficiency and runs up maintenance expense. Likewise, it is no longer economical or efficient to maintain yard switches only just good enough to permit cars to be shoved in on them. Keeping constantly familiar with standard maintenance of way rules and their proper application, keeping abreast with tried and proven maintenance practices as followed by others, through the reading of magazines and books devoted solely to the study of track and its maintenance in general will do much to enable trackmen to attain more readily the knowledge that is so indispensable to the maintenance of turnouts to that high degree of perfection that is so essential in these days of increasing speeds, longer and heavier train loads and heavier switching power.

Examination of the Switch Stand Should Form a Part of Each Switch Inspection

Committee—F. J. Liston (chairman), rdm., C. P., Montreal, Que.; L. M. Denney (vice-chairman), supv. C. C. C. & St. L., Indianapolis, Ind.; J. L. Baker, rdm., C. B. & Q., Wymore, Neb.; F. H. Masters, asst. chief engr., E. J. & E., Joliet, Ill.; J. G. Sheldrick, res. engr., Soo Line, Minneapolis, Minn.; E. E. Young, div. engr., C. B. & Q., Hannibal, Mo.; I. D. Talmadge, rdm., N. Y. O. & W., Middletown, N. Y.; O. V. Parsons, asst. engr., N. & W., Roanoke, Va.; N. E. Peterson, C. & I. M., Springfield, Ill; A. L. Pollock, rdm., A. T. & S. F., Los Angeles, Cal.; A. W. White, engr. track, C. & O., Richmond, Va.; F. L. Lemon, supv., N. Y. C., Ashtabula, Ohio; H. Olson, rdm., C. P., Consul, Sask.; H. H. Gudger, rdm., M. P., Monroe, La.; M. King, rdm., W. & L. E., Brewster, Ohio; D. R. McWilliams, supv., B. & O., Clarksburg, W. Va.

Discussion

The discussion of this report centered almost entirely around the relative merits of staggered, or opposite, joints immediately ahead of switch points. G. L. Sitton (Southern) disagreed with the recommendation in the report that the joints should be opposite and suggested that where staggered joints could not be secured readily, while keeping the next adjacent joints beyond the heel of the switch points, the joints in advance of the points might be welded.

Chairman Liston said it was the common practice on his road to square the joints ahead of points, and agreed with the practice, pointing out that this had a tendency to promote better riding through the turnout, the equipment starting through leveled up, rather than with a possible rocking or rolling motion. On a suggestion by J. C. Runyon (C. & O.) that it was more difficult to maintain good line with opposite joints, it was brought out that some trouble had been experienced in this respect, especially as the result of long wheel-base locomotives coming out of turnouts. Chairman Liston agreed that there was a possibility of long locomotives tending to throw the track out of line when moving out of turnouts with opposite joints ahead of the points, but said that with ordinary maintenance of the joints, he had never experienced any special difficulty in this regard.

F. B. La Fleur (S.P.) saw objection to the welding of the joints in the fact that with the necessity for replacing the stock rails because of wear, two rails would have to be renewed, but it was pointed out by E. W. Walch (C. & N.W.) that this objection could be overcome by cutting the two rails apart when it became necessary to renew the stock rails, leaving the length ahead of the points in place for further service.

W. H. Sparks (C. & O.) indicated entire lack of sympathy with opposite joints ahead of switch points and said that every track foreman knows that squared joints, with the combined impact of both wheels on the tie, increases the problems of maintenance. With 30-ft. switch points especially, he saw no objection whatever to placing a joint in the stock rail on the turnout side

where traffic is ordinarily the lightest, which would permit the staggering of the joints ahead of the points.

Continuing his comments, Mr. Sparks said that one of the greatest shortcomings in turnout construction today is the limited length of lead provided. He attributed this to a holdover from the days of lighter and smaller power, and cited incidents to show that it is almost impossible to move some of the large power of today through some turnouts without undue strain on the entire track structure, and the possibility of derailments.

Other points discussed had to do with the proper method of attaching the switch stand to the head blocks, whether by spikes or by bolts as suggested in the report, and concerning the desirability of providing adequate bearing plates beneath the toe and heel of frogs.

The Track Supply Exhibit

Jess Mossgrove
President

Lewis Thomas
Secretary-Treasurer

FORTY-FIVE manufacturers of equipment and materials used in the construction and maintenance of track presented exhibits of their products at the convention under the auspices of the Track Supply Association, the exhibit being immediately adjacent to the convention meeting room, where adequate space was available and where the examination of the displays by those attending the convention was assured. The number of exhibitors this year, and the size of exhibits were larger than in recent years, being exceeded only last year when 53 members presented exhibits.

The officers of the Track Supply Association who were responsible for the exhibit were: President, Jess Mossgrove, Austin-Western Road Machinery Co., Aurora, Ill.; vice-presidents, Lem Adams, Oxweld Railroad Service Company, Chicago, and R. J. McComb, Woodings-Verona Tool Works, Chicago; secretary-treasurer, Lewis Thomas, Q & C Company, Chicago; directors, H. H. Talboys, Nordberg Manufacturing Company, Milwaukee, Wis.; J. E. Mahoney, P. & M. Co., Chicago; F. W. Anderson, Northwestern Motor Company, Eau Claire, Wis.; E. C. Argust, Morden Frog & Crossing Works, Chicago; R. M. Blackburn, Buda Company, Chicago; H. C. Mull, Warren Tool Corporation, Warren, Ohio; and H. H. McFarlane, O. F. Jordan Company, East Chicago, Ind.

In the election of officers of the association, which took place on Thursday morning, Lem Adams was advanced to president and R. J. McComb to first vice-president; E. C. Argust was elected second vice-president, and Lewis Thomas was re-elected secretary-treasurer. The new directors elected were F. P. Cullen, Cullen-Friestedt Company, Chicago; H. C. Hickey, The Rail Joint Company, Inc., Chicago; and W. W. Fitzpatrick, Nordberg Manufacturing Company, Chicago. These men succeeded Messrs. J. E. Mahoney, F. W. Anderson, and E. C. Argust.

A list of the exhibitors, together with the products on exhibit and the names of the representatives present follows:

List of Exhibitors

Air Reduction Sales Company, New York; welding and cutting equipment; oxygen and acetylene regulators; carbide lights, lamps and lanterns; carbide; welding rods; goggles; pipe welding, rail cropping, butt-welded rail; and built-up and heat-treated rail joints; C. B. Armstrong, A. W. Brown, C. A. Daley, J. T. Gillespie, J. W. Kenefic, J. W. Knowles, L. C. McDowell, U. F. Portel, H. L. Rogers, E. F. Turner, M. M. Weist, and D. J. Williams.

American Fork & Hoe Company, Cleveland, Ohio; rail anchors; tapered rail-joint shims; shovels; weed cutters; forks, rakes; scuffle hoes; and broom rakes; H. C. Branahl, G. L. Dunn, S. L. Henderson, J. J. Nolan, Frank J. Reagan, and F. C. Stowell.

Austin-Western Road Machinery Company, Aurora, Ill.; models and moving pictures and literature on air dump cars; H. F. Barrows, J. D. Benbow, H. B. Bushnell, Jess Mossgrove, and Bruce P. Smith.

Barco Manufacturing Company, Chicago; gasoline tie tampers, flexible ball joints; and gasoline hammer; C. E. Allen, F. N. Bard, W. J. Belhke, C. O. Jenista, L. J. Lytle, C. L. Mellor, and F. B. Nugent.

Buda Company, Harvey, Ill.; section motor car; inspection motor car; mechanical tie tamper; switch stand; bonding drill; track drill; track liner, rail bender; journal jacks; track jacks; hydraulic jacks, pole jacks, and tie spacers; H. C. Beebe, R. M. Blackburn, H. S. Brown, R .B. Fisher, F. L. Gormley, R. K. Mangan, and G. A. Secor.

Chipman Chemical Company, Inc., Bound Brook, N.J.; Atlacide weed killer; atlacide dusting powder; N. J. Leavitt, A. A. Murphy, J. Murawski, and I. J. Strain.

Creepcheck Company, Inc., Chicago; rail anchors; T. D. Crowley, R. R. Dinklage, and N. A. Howell.

Crerar, Adams & Co., Chicago; track and bonding drills; track tools; tie bander, wrenches; rust-proof paint; hydraulic pipe pushers; and conduit bender; Edward C. Poehler, Irving E. Poehler, J. M. Temple.

Cullen-Friestedt Company, Chicago; motion pictures of Burro locomotive crane in operation; and rail tongs; W. C. Bamber, K. J. Beller, L. B. Bertaux, C. J. Bronez, E. V. Cullen, F. J. Cullen, F. P. Cullen, T. G. Frazee, G. H. Goodell, Robert W. Jamison, F. L. Kendig, and Jos. F. Leonard.

deSanno & Son, A. P., Philadelphia, Pa.; Radiac grinding wheels; J. C. Rinehart, E. J. Rohan, and W. K. Whelan.

Differential Steel Car Company, Findlay, Ohio; photographs of dump cars and literature; H. F. Flowers, Shelby G. Hughes and David E. Flowers.

Duff-Norton Manufacturing Company, Pittsburgh, Pa.; track jacks; power jacks; journal jacks; automatic lowering jacks; and tie spacers; C. N. Thulin and E. E. Thulin.

Elastic Rail Spike Corporation, New York; Elastic rail spikes; C. M. Bernuth, William A. Fisher, A. C. Jack, and B. Kuckuck.

Fairmont Railway Motors, Inc., Fairmont, Minn.; inspection cars; section car; and heavy-duty motor car; C. P. Benning, W. D. Brooks, Kenneth Cavins, W. G. Day, Arthur R. Fletcher, C. H. Johnson, W. F. Kasper, J. T. McMahon, V. Pagett, W. H. Ripken, H. A. Sly, Ira Sublett, and William Williamson.

Hubbard & Co., Pittsburgh, Pa.; track tools; alloy track chisels; spike mauls; sledges; picks; wrenches; claw bars; adzes; and alloy spring washers; D. J. Crowley and J. S. Wincrantz.

Illinois Malleable Iron Company, Railroad Division, Chicago; rail anchors; Chas. G. Ericson, Dayton T. Hogg, and H. A. Morean.

Jordan Company, O. F., East Chicago, Ind.; model and pictures of spreader ditcher; A. W. Banton, O. L. Champion, J. C. Forbes, H. M. McFarlane, and C. W. Shipley.

Kalamazoo Railway Supply Company, Kalamazoo, Mich.; one-man inspection car; light section motor car; signal maintainer car; motor-car wheels; and track gage and level; Ralph E. Keller, Frank E. McAllister, and P. J. Robischung.

Lundie Engineering Corporation, New York; tie plates; tie tongs; and rail lubricator; L. B. Armstrong, D. H. Meyer, and O. W. Youngquist.

Maintenance Equipment Company, Chicago; switch point protector; rail and flange lubricator; derail; and literature on rail layer; D. M. Clarke, E. Overmier, T. E. Rodman, R. J. Shanahan, and P. A. Wells.

Mall Tool Company, Chicago; portable rail grinders; flexible-shaft cross-grinder; concrete vibrator; sump pump; 10-in. power saw; chain timber saw; lagscrew wrench; boring attachment; concrete rubber; and wire brushing attachment; electric drills, electric saws; J. Innes, A. W. Mall, F. A. McGonigle, and M. Rhenquist.

Metal & Thermit Corporation, New York; Thermit-pressure, rail welds and electric welding rods; A. Lucas and C. D. Young.

Morden Frog & Crossing Works, Chicago; heat-treated forged compromise joints; adjustable rail braces; and miscellaneous forged fittings for switches; E. C. Argust, W. Homer Hartz, G. F. Killmer and L. I. Martin.

Nordberg Manufacturing Company, Milwaukee, Wis.; rail grinders; track power drill; power track wrench; utility rail grinders; and accessories; C. P. Clemmens, W. W. Fitzpatrick, C. K. Jensch, and H. H. Talboys.

Northwestern Motor Company, Eau Claire, Wis.; B. & B. gang car and an all-service section car; F. W. Anderson, Otis B. Duncan, W. F. Hebard, A. H. Nelson, and G. Prest.

Oxweld Railroad Service Company, Chicago; oxy-acetylene welding and cutting apparatus; oxygen; acetylene; carbide; actual examples of battered joint reconditioning; rail butt welding; angle bar welding; switch point welding; frog welding; application of switch point protectors; and heat-treating of rail ends; Lem Adams, M. Burnett, Jr., W. E. Campbell, W. E. Donalds, S. P. Donegan, F. J. Duffie, A. F. Garberding, J. R. Garrett, W. A. Hogan, P. Hunter, Jr., W. H. Kofmehl, D. H. Pittman, C. E. Rigsby, L. C. Ryan, J. C. Stephenson, F. C. Teichen, and J. E. Winslow.

P & M Company, Chicago; rail anticreepers and bond-wire protectors; and tie plate assemblies; D. T. Hallberg, G. E. Johnson, J. E. Mahoney, W. A. Maxwell, Max K. Ruppert, and G. T. Willard.

Pettibone Mulliken Corporation, Chicago; mechanical switchman; switch stands; model of railroad crossing; manganese guard rail; gage rods; and shoulder bolts and joint wedges; J. H. Asselin, Walter Brietzke, A. R. Hearl, C. A. Johnson, Carl Landberg, G. R. Lyman, J. D. Potts, and G. J. Slibeck.

Pocket List of Railroad Officials, New York; copies of Pocket List of Railroad Officials; H. A. Brown and B. J. Wilson.

Positive Rail Anchor Company, Chicago; rail anchors; guard-rail plates and braces; and adjustable rail braces; L. C. Ferguson and R. J. Platt.

Q & C Company, New York; guard-rail clamp; switch-point guard; compromise joints; derail; gaging tools; rail and flange lubricator; wheel stops; rail tongs; gage rods; flangeway guard; and adjustable rail brace; G. H. Goodell, L. E. Hassman, E. I. Hetsch, G. Prest, J. L. Terry, Lewis Thomas, and C. H. Wilson.

Rail Joint Company, Inc., The, New York; insulated rail joints; standard joints; controlled bearing joints; compromise joints; and fibre insulation; V. C. Armstrong, E. W. Backes, Alex Chapman, W. E. Gadd, Harry C. Hickey, G. H. Larson, J. N. Meade, R. W. Payne, and Thomas Ryan.

Rails Company, The, New Haven, Conn.; M. & L. track; compression track construction; compression screw spike; full throated cut spike; oil, gas and electric switch heaters; track lubricator; and spring spike; R. E. Bell, L. T. Burwell, G. M. Hogan, and J. V. Wescott.

Railway Engineering and Maintenance, Chicago; copies of **Railway Engineering and Maintenance** and Railway Age; G. E. Boyd, L. R. Gurley, S. W. Hickey, N. D. Howard, Elmer T. Howson, F. C. Koch, J. G. Little, H. E. McCandless, H. A. Morrison, and J. S. Vreeland.

Ramapo Ajax division of American Brake Shoe and Foundry Co., New York; switch stands; rail lubricators; and metal highway crossings; T. E. Akers, W. Bender, G. A. Carlson, J. E. Davidson, R. E. Einstein, H. Hazelton, J. V. Houston, A. P. Hess, Darcy F. Hilton, P. Hoffman, A. F. Huber, J. S. Hutchins, W. Janicki, S. A. McVickers, and W. Perdue.

Rawls Company, S. E., Streator, Ill.; railway track and right-of-way mowing equipment; C. F. Butts, E. J. Jaeger, and S. E. Rawls.

Reade Manufacturing Company, Inc., Jersey City, N.J., D. M. DeWitt, C. A. Parish, Charles H. Reade, and Charles F. Reade.

Republic Steel Corporation, Cleveland, Ohio; culverts; guard rails; track and frog bolts; W. J. Hanna, W. T. O'Neill, C. W. Ruth, L. L. Soljer, and A. J. Roof.

Richter Electric Mower, Beardstown, Ill.; track mower; O. B. Richter, and T. G. Storey.

Sperry Rail Service, Hoboken, N.J.; exhibit showing motion picture and samples of electric flash butt-welded rails and of rail defects located by detector cars; E. A. Crawford, J. B. Farwell, and C. W. Gennet, Jr.

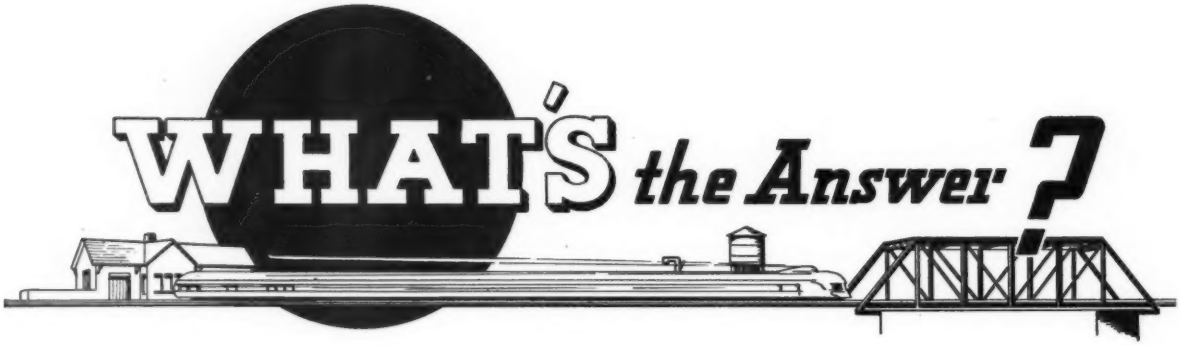
Standard Equipment, Inc., Chicago; Evertite rail joints; C. O. Bradshaw, Robert S. Fletcher and Albert E. Hill.

Templeton, Kenly & Co., Ltd., Chicago; track, bridge and journal jacks; tie spacer; and rail puller and expander; E. D. Carthy, R. B. Hill, P. H. McManus, William Simpson, J. B. Templeton, and W. B. Templeton.

Woodings-Verona Tool Works and Woodings Forge & Tool Company, Verona, Pa.; rail anchors; gaging tools; spring-clip and bent-shoulder tie plates; spring washers; and triflex springs; James McComb, R. J. McComb, G. L. McKewin, J. M. Moore, E. Woodings, and W. H. Woodings.

Woolery Machine Company, Minneapolis, Minn.; tie cutting machine; A. J. Franke, J. W. Vogler, and H. E. Woolery.

Approximately 100 Members of the Roadmasters Association Visited the Plant of the Pettibone Mulliken Corporation, at Chicago, on the Last Day of the Convention.



Service Life of Rail

What are the indications that rail is approaching the end of its service life? What changes occur in rail with age?

No General Rule

By Armstrong Chinn
Chief Engineer, Alton, Chicago

No question with which the maintenance forces are confronted is more productive of discussion than this one. For years attempts have been made to develop a conclusive answer, but today opinions are still as divergent as ever. One thing may be said with some degree of certainty, however, and this is that during the last five or six years of restricted maintenance, maintenance men have revised their ideas concerning the service life of rail. Working with severely restricted allowances, they have found that with certain attention, such as restoring battered ends by welding, the application of joint-bar shims or reformed bars, cropping rail ends, better anchorage and better bolt maintenance, rail can be made to last much longer than they had thought possible and still be made to ride safely and smoothly.

In main tracks particularly, rail is seldom renewed because it is worn out or has become unsafe. Normally, it is renewed long before that stage is reached, and is used again in less important tracks, that is, in branch lines, sidings and yards. In determining when rail has reached the end of its service life, many factors must be considered, including its weight, the class of the track, and the type, weight and speed of the equipment passing over it. Rail that might not be suitable for an important main line might be in excellent condition for use in a secondary line, a passing siding or a yard track.

Numerous methods have been suggested for determining when rail is worn out, including the number of failures, the amount of wear and the gross tonnage that has passed over it. While all of these have a bearing on its life, probably no factor carries so much weight, particularly in main tracks, as the way it rides. This is true today, more than ever before, for modern high speed trains demand smooth track.

As the rail wears under traffic its surface becomes less smooth, and its ends batter and sometimes bend down as a result of wear on the fishing surfaces of the rail and joint fastenings. These conditions produce poor riding rail. They can be improved by welding and by the application of joint shims or reformed bars. Eventually, however, the rail will reach a condition where no amount of maintenance can make it ride satisfactorily, and it has then reached the end of its service life in main track.

Age, itself, does not change rail, but traffic and weather do. Traffic causes the running surface to become less smooth, to harden and become dense for a depth of about $\frac{1}{16}$ in., and to wheel burn. On curves the side of the head of the high rail is abraded by the wheel flanges, and the head of the low rail mashes and batters. The rail ends batter and chip and the fishing surfaces wear. Traffic also causes the development of pipes, transverse fissures and split heads, and a certain amount of wear where the base is in contact with tie plates, anti-creepers and spikes. In other words, traffic causes the rail to wear out; and weather and brine drippings cause corrosion, which may become so severe that the base may be-

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in December

1. *In what ways do rails become damaged in handling? What are the results? How can this be prevented?*
2. *Under what conditions is it desirable to apply diagonal sheathing in frame buildings? What are the advantages? The disadvantages?*
3. *When personal injuries occur in maintenance of way gangs, what steps should be taken to ascertain the cause? Who should conduct the investigation?*
4. *How does one go about cutting out rivets with an acetylene torch in steel bridges? Is this good practice?*
5. *Where the track heaves at the end of an open-deck bridge, should the section forces be allowed to place shims on the bridge, or should a slow order be placed until bridgemen can get to the structure? Why?*
6. *Is there any advantage in the use of explosives to increase the flow in deep wells? If so, under what conditions? How can this be done?*
7. *What considerations should govern the design and location of flanger signs?*
8. *What types of paint or other coatings give the best protection to wood and steel surfaces in enginehouses?*

come weakened to the point where renewal becomes necessary before the head is worn out.

Rail Does Not Wear Out

By Engineer Maintenance of Way

Rail generally reaches the end of its service life for only three reasons: (1) because of external damage; (2) because of internal defects; and (3) for economic reasons. I am aware that some might add a fourth reason, wear, but in 40 years' experience I have seen only a limited amount of rail, except that from curves, discarded because it was actually worn out. Sufficient wear to end its service life does occur where sand is used frequently, on certain yard leads and ladders and elsewhere where the service is particularly severe, but these are special and not general cases. As evidence that wear is a minor cause in determining the life of rail, it may be pointed out that there is today more than 100 miles of iron rail in the main tracks of Class I railways of the United States.

External damage occurs by reason of derailments, improper counterbalance, flat wheels, striking the web or flange with a maul, allowing the base to ride the shoulders of tie plates, floods, slides, fire and other causes which break or distort the rail beyond the possibility of further use. Corrosion from brine drippings, the action of locomotive cinders and other corrosive agents have terminated the life of much rail that could otherwise have remained in service indefinitely. The evidence of these forms of damage is so obvious as to need no discussion.

Internal defects include transverse and horizontal fissures, pipes, split heads, fillet cracks, web cracks, base seams, segregation and shatter cracks. All of these defects, except fissures and base seams, present ample advance evidence of approaching failure that can easily be recognized by an experienced trackman. Through the use of the detector car, failures in service from internal fissures can now be prevented or reduced to the minimum. Generally, however, the fish-tail breaks that result from base seams occur suddenly without warning.

Sound rail in main tracks deteriorates first and most noticeably at the joints from batter, chipping and wear on the fishing surfaces of the rail and joint bars. While this can be retarded by proper maintenance, it cannot be prevented wholly. The rail can be reconditioned, however, and its use in the original application can be extended appreciably by building up the ends and applying joint shims or reformed bars. When the point is reached where smooth track can no longer be maintained economically it can be relaid in tracks where the service is less severe and if this is done progressively it can finally be used in yards or unimportant sidings. In this way its service life can be extended indefinitely.

Generally, the life of rail in primary service is determined by the necessity for maintaining the track in good riding condition and the cost of doing this. In the past and to a large extent at present the determining factor has been and is the need for heavier and stiffer rail to withstand the traffic loads. Much of the rail that is discarded from minor service, such as yards and sidings, and even from secondary lines, is having its service life terminated for the same reason—that is, the lower cost of maintenance where stiffer rails is used.

Paint Inspections

When making a paint inspection, what details should be observed? What are the indications that determine whether painting is required?

Differ for Wood and Steel

By W. E. Gardner
Principal Assistant Engineer, Wabash, St. Louis, Mo.

Paint is applied to structural surfaces (1) to protect them; (2) to improve the appearance of the structure; (3) to improve lighting conditions; (4) to improve sanitary conditions; and (5) to convey a definite message through color indication and arrangement. In the maintenance of structures, except for item (1), a superficial inspection will be sufficient to determine whether the condition of the paint is satisfactory or whether cleaning or repainting is necessary.

Indications of paint failure on wood surfaces are somewhat different from those on iron and steel, for which reason the manner of making the inspection is somewhat different. In the case of wood surfaces, particularly on structures such as passenger stations, the time to repaint is before the old paint film has failed. If this is done, one coat of paint should last about five years.

Old paint films should be examined for chalking. Chalking or weathering thins the paint film and will eventually expose the wood surface. By rubbing one's hand over the film the weathered paint is removed and it is not difficult to decide whether the remaining film is sufficient to protect the surface. Weathering or chalking is the natural process by which paint fails and is the most desirable form of paint failure. It is also the mildest form of failure, and must be expected, but in the better quality of paints the elasticity of the film is greater, for which reason chalking does not start so soon or progress so rapidly and to the extent as it does in the poorer quality of paints.

Paint failures that are characterized by cracking, peeling, blistering, etc., which expose the wood are not natural. They result from poor quality paints, painting over wet surfaces, painting in damp weather, failure to allow sufficient time for drying before the succeeding coat is applied, etc. When the examination of the paint discloses exposed wood in an appreciable amount, it is time to repaint. The sides of buildings which have the greatest exposure to the sun have the poorest paint conditions. In some cases, the undersides of overhanging roofs will require painting before the body of the building does. It is then a matter of policy whether only such painting as is necessary for protection shall be done, or whether the entire structure shall be painted.

Incipient paint failure on iron and steel surfaces is indicated by rust spots on the surface or by rust streaks washed down on walls, abutments, etc. When rusting appears to be progressing rapidly over large areas, the structure should be repainted, unless general appearance can be sacrificed to take advantage of the economy of spot painting. When making an inspection of steel structures, particularly bridges, close attention should be given to all horizontal surfaces and the adjacent vertical surfaces, where moisture collects and stands.

Those surfaces of steel structures that face oncoming traffic carrying brine drippings, which will thus be splashed against them, should be examined frequently and carefully, and be repainted as soon as evidence of rusting becomes apparent. In many cases the cost of cleaning steel surfaces that have been neglected, especially those exposed to brine drippings, will more than equal the cost of painting

that is done before the paint has failed and corrosion has progressed far.

If the cost of repainting could be forgotten and if repainting were done before the old paint has failed, the results would be economical in the long run. Deterioration of the old paint is usually stopped by the application of new paint over it. The expense involved in the removal of the old paint is avoided by stopping deterioration before it progresses to the point where repainting will not be satisfactory.

Depends on Structure

By Master Carpenter

When making an inspection of bridges to determine the painting requirements for the following year, the type of structure will determine some of the details that must be given particular attention. To illustrate, if the bridge has a waterproofed floor, one should look for possible leaks and resulting destruction of paint along the flanges of floor beams and main girders, or on the columns and cross girders of track-elevation structures, especially those of 15 to 20 years ago. On open-deck bridges, the floor system usually suffers more from paint failure than other members of the structure.

In thickly settled communities there is often much destruction of paint by mischievous boys and sometimes even by men. In such places paint is often affected seriously by industrial gases, and painting may be required twice as frequently as in the open country. In certain sections of sparsely settled country, we have had much damage to bridge paint because persons have marked targets on the outside of girders and used them for rifle practice.

It has been my experience that building paint blisters more often than bridge paint, especially on window sills and siding. This is sometimes caused by carelessness in preparing the surface, but I think much of the trouble can be laid to a poorer grade of paint for buildings than for bridges.

Preventing Trouble with Gasoline

What precautions should be taken to insure against the use of inferior gasoline, or dirt or water in the gasoline, for use in gasoline-driven power units?

Extremely Aggravating

By District Engineer

There are few things connected with the operation of power equipment more aggravating than to have the engine sputter a few times and stop, only to find that the gasoline contains water or that the carburetor has become clogged with dirt, particularly if this holds up progress on a job upon which a considerable number of men are employed. Since maintenance of way work is spread over a wide area and power units are used at widely separated points, while a large number of men may be involved in the storage, handling and delivery of gasoline, it is unlikely that such incidents will ever be eliminated completely; yet by proper precautions and constant supervision they can be reduced to the point where they will be of such rare occurrence that they become practically negligible.

In my experience gasoline has ordinarily been delivered by wagons directly to the storage tanks. We have never had any difficulty in obtaining the grade we wanted, so that inferior gasoline has never been one of our troubles. We have found, however, that certain drivers need to be checked for, through carelessness rather than intent, on several occasions we have had kerosene substituted for gasoline, much to the detriment of the operation of the motor cars for which it was intended.

Filters will eliminate much but not all of the trouble experienced from dirt. Where gasoline must be delivered to the job in drums, it requires constant watchfulness to keep the drums clean. I have sometimes instructed that it be passed through a chamois skin while the tank on the power unit is being filled. This increases the time of filling slightly, but not enough to cause disruption of the work if this becomes necessary during working hours. If the filling is done after hours the extra time required is negligible. Open lights must never be used when filling the tanks.

If care is exercised, about the only water that will get into the gasoline will be that from atmospheric condensation. Where it is handled in drums, this can be avoided in large part by eliminating the use of partly-filled drums. Drums should be filled and upon delivery should be emptied as rapidly as the requirements of the job will permit.

Water in fixed storage tanks is another matter. With proper precautions this will have its source in condensation also. To prevent trouble with water and sediment in these tanks, they should be provided with means for pumping out or draining from the bottom without disturbing the remainder of the liquid. Both water and dirt, being heavier than the gasoline, will readily settle to the bottom and can be drained or pumped off without loss of the overlaying gasoline, if sufficient care is exercised to avoid disturbing it.

Gives Four Precautions

By F. F. Zavatkay

Supervisor of Welding and Equipment, New York, New Haven & Hartford, New Haven, Conn.

To insure that gasoline will be up to the standard required for the efficient operation of the power units, it should be purchased to specifications and be subject to strict inspection. Proper facilities must be provided for the storage and handling of the gasoline after delivery to exclude contamination by dirt and other foreign substances. These facilities should also be designed to exclude water from atmospheric condensation. Even with the strictest precautions, however, some moisture is likely to get in, for which reason the storage tanks should be provided with settling sumps from which the water can be removed by draining or pumping.

So far as practicable, the practice of allowing gasoline drums to remain partly empty should be avoided to eliminate the difficulty that is almost invariably experienced with water in the gasoline from such drums as a result of condensation.

Has Overcome Difficulty

By C. R. Edwards

Supervisor of Scales and Work Equipment, Wabash, Decatur, Ill.

Recently we have not experienced any trouble from inferior gasoline, since we are now purchasing most of what is used by the maintenance of way department from tank wagons and are using "regular" gasoline. In the past, however, dirty gasoline and water in the gasoline have caused us considerable trouble and expense, dirty gasoline having given us the most trouble. Numerous and expensive delays have been experienced as a result of clogged carburetor jets, especially in the smaller power units.

We have eliminated practically all

of this trouble from dirt by installing good gasoline filters. We have also raised the outlet pipes of the gasoline storage tanks about an inch above the bottom of the tanks so that any dirt or water that may accumulate will settle to the bottom and can be drained off. These improvements have also been supplemented by a campaign to secure clean storage cans.

When to Set Grade Stakes

Where track is to be given a general raise, is it desirable to set grade stakes on one side of the track or on both sides on tangents? On curves? Why? Should the grade line be referred to the top or to the base of the rail? Why?

On One Side Only

By J. B. Martin

General Inspector of Track, New York Central, Cleveland, Ohio

When track is being given a general raise, it is sufficient to set grade stakes on one side only of the track, on both tangents and curves. It is the general practice to use sighting (spot) boards and blocks when raising track. These boards are of sufficient length to reach from the top of the grade stake across both rails of the track. They are provided with a level glass and are placed level, the sighting blocks are placed on top of the rail and this insures that the true grade will be carried. The grade line should be referred to the top of the rail as this is always used for sighting purposes.

A Waste of Time

By J. P. Mumford

Assistant Supervisor, Southern, Birmingham, Ala.

Grade stakes are not necessary on both sides of the track on either tangent or curve. The grade should be referred to the top of the rail and set accordingly, within reach of the level board. In surfacing track, or in doing other work as well, too many stakes are a hindrance rather than a help, for they are in the way of the men, slowing down the work because of the unnecessary care that must be taken to avoid knocking them to one side. The foreman finds no difficulty in working to a single line of stakes, and the ultimate result is the same as if this line were duplicated. With one line of stakes, the foreman uses two levels, one from the stake to the nearest rail and the other across the rails, or he uses a spot board and a level. With two lines of stakes he will need three levels, one from each stake to its nearest rail, and one across the rails to check the cross level.

Grade stakes should always be set along the low rail on curves. The foreman can establish his new grade and then raise the outer rail to conform to the superelevation.

To the Top of the Rail

By W. L. Roller

Division Engineer, Chesapeake & Ohio, Columbus, Ohio

Surfacing out of face on old well-established tracks is generally for the purpose of restoring the track to its original elevation, that is, to overcome the subsidence that has taken place since the last general raise, as well as to provide smooth resilient track. In heavy-tonnage territory, tracks supported on stone ballast are known to have subsided at the rate of at least 1 in. a year. This settlement can easily be discerned at crossings with well-established highways. Since the lifts are undertaken to re-establish the original grade as well as to improve track conditions, the grade should be referred to the top rather than the base of the rail, especially since the lifts are relatively light, usually ranging from 2 to 4 in. Stakes for surfacing new rail should also be related to the top of the new rail. The data for preparing the profile should be obtained after the rail is laid, if this is practicable. This reference is especially important through towns and elsewhere where crossings at grade are encountered, since the top of the rail is related to those of important highways at crossings where high-speed vehicular traffic must be accommodated.

It seems to me that it should be optional whether stakes are set on one or both sides of the track. I see no necessity for two lines, since the near rail is usually lifted to a spot board and the other one is brought up to the same plane by means of a track level. On curves, the stakes should be set along the inside rail and the outer rail can thus be brought to the correct superelevation by means of the level.

Annual Tie Inspection

Who should make the annual tie inspection? Why? What check of the inspection should be made?

Ties Last Longer Today

By W. H. Sparks

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Ties last longer in modern track than they did only a few years ago, because the timber is selected more carefully, the rail is heavier and the ties are better protected. Many ties that are now 20 years old are in better condition with respect to bearing and holding power than many ties were formerly when only 5 years old, for our heavy tie plates have eliminated cutting and have practically eliminated gaging, preboring has retarded decay around the spikes and special rail fastenings have also reduced the abuse to which ties were formerly subjected. All of these items have a profound influence on tie inspection, compared with the former period, for as the tie approaches the end of its life it remains more dependable than formerly.

Supervisors and section foremen should make the inspection jointly. They are primarily responsible for the safety and riding conditions of the track, they are familiar with the physical conditions and traffic on their respective territories, and they know more intimately than anyone else the maintenance requirements for their track. Obviously, however, there should be some check on the judgment of these men and this can be obtained by checking a few miles at random on each supervisor's district.

Supervisor Knows Best

By W. E. Folks

Track Supervisor, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio

Tie replacement is expensive, the cost of ties themselves having tripled in the last three decades. Tie inspection should be made by a man of experience and seasoned judgment, to insure that enough but not too many

ties are called for. The supervisor possesses these requisites, in addition to which he is thoroughly familiar with the requirements of the situation and can, therefore, be depended on to estimate the tie requirements better than any one else. I do not believe in bringing in outside inspectors who know nothing of local conditions.

Foreman Should Make It

By C. D. Turley
Chief Tie Inspector, Illinois Central, Chicago

The annual tie inspection should be made by the section foreman, because he is more familiar with the peculiarities of his track than any one else. This inspection should be made and recorded by miles, and, in multiple-track territory, by tracks. The supervisor, who is familiar with his district, should discuss the matter with each of his foremen and make a joint check of one or more miles on his section.

The division engineer, who is responsible for the tie condition on the entire division, should discuss with his supervisors the policy to be followed and check a portion of each district to make sure that instructions are being followed and that a safe and uniform tie condition will be insured throughout every district. The standards of tie maintenance, as determined by the engineer maintenance of way, should be uniform throughout the system for each class of track, and the foregoing plan will tend to bring about a uniform tie condition.

By Supervisor and Foreman

By W. H. Brameld
Assistant to Chief Engineer Maintenance of Way, Erie, Cleveland, Ohio

Determination of the number of crossties that should be renewed should be made through an annual tie inspection conducted by the track supervisor, accompanied by the section foremen on their respective sections. The estimate prepared from the inspection should be checked by the general roadmaster. Division engineers should supervise the inspection closely. While it is in progress he should frequently examine the records of the inspection and where unusually large renewals are called for and the necessity therefor is not known, he should make a personal inspection to check the accuracy of the estimate.

Where the inspection is left to the foreman, it is difficult to obtain uniformity, because some foremen are conservative, while others are just the opposite. Where the responsibility is placed on the supervisor, he uses the same basis of inspection over the entire subdivision.

Foreman Knows Best

By L. E. Brune
Section Foreman, Wabash Nameoki, Ill.

Every section foreman is over his track constantly and has a more intimate knowledge of its needs than any one else can possibly have. During the working season he has the cribs open to surface or spot his track and is thus able to familiarize himself with the condition of the ties. To simplify the annual tie inspection, it is an excellent practice at this time to mark all ties in which hidden defects are noted that will require replacement.

It is essential that every tie be kept in service as long as possible without detriment to safety or riding conditions. Supervisory officers have too many duties to permit them to take the time that should be given to tie inspections over a large mileage. Close inspection to determine the merits of every tie will require him to spend much time on a section, and this is multiplied by the number of sections under his jurisdiction. As I see it, the section foreman should make the inspection in the first instance, as he can do this with less interference with his other duties. The supervisor can then check one or more miles on the section to ascertain that the standards of maintenance have been complied with and that proper economy will be practiced in the replacements.

Wear in Wire Rope

What is the most important cause of wear in wire rope? What can be done to reduce it? How often should wire rope be inspected and who should make the inspection?

Lack of Lubrication

By C. E. Miller
Assistant Engineer of Maintenance, Chicago & North Western, Chicago

There are many causes for wear in wire rope and also many failures that result from abuse rather than wear. In general, I believe that the most important cause of wear is lack of proper lubrication. To insure proper lubrication it is necessary that the lubricant shall penetrate the rope and protect the inner wires against corrosion and internal friction, as well as protect against external wear.

Operators of machines using wire rope may be misled by the outer surface appearing to be well lubricated when, in fact, the lubricant may have but little penetrating power, leaving the interior elements a prey to friction and severe corrosion. Wire rope must be of the proper size and tensile requirements safely to handle the capacity load. The sheave diameter should be of ample radius to insure that the rope will not be subjected to excessive bending stresses in passing over it, which invariably occurs when the radius is too small. The grooving of the sheaves is most important. If the groove is too narrow for the diameter of the rope, it will be pinched and distorted, causing excessive wear where the distortion occurs, besides causing high internal stresses and friction. Conversely, if the groove is too wide, the rope will not receive proper side support and it will flatten out, causing distortion and excessive stresses in the individual strands.

When a new wire rope is received in a coil, it should be rolled out and well straightened to avoid kinks, before it is installed. It should never be uncoiled by throwing off the coils, as may be done without injury with a hemp rope. A kink in a wire rope will cause serious injury to it. Even if some of the wires are not broken through kinking, the contour will be distorted and excessive wear will take place in the distorted strands. When a wire rope has been installed on a machine, it should be operated at light load for a short time to enable it to adjust itself and take its final set before it is subjected to a full load.

Care must always be exercised to see that cable sheaves are also kept lubricated and operating freely so that the wire rope will not be damaged by dragging it over an inoperative sheave, or over any other fixed part of the machine. Wire rope should not be subjected to excessive heat and should, therefore, be guarded against fire and protected from molten metal where welding is being done. Cross winding or overwinding of wire rope on drums should be avoided where possible, as this will cause abrasion and excessive wear.

Operators should make daily in-

spections of ropes on machines or other equipment, which are carrying heavy loads so that he may be familiar with the state of wear and deterioration and be in position to change them out before they become unsafe. While making this inspection, he should also inspect the cable clips and keep them tight and in proper position. Work-equipment inspectors or maintainers should also inspect these ropes at every available opportunity; probably at intervals not greater than 30 days.

Generally, wire rope is subjected to heavy stresses and is used in equipment such that its failure is likely to result in serious personal injuries and property damage. For this reason, it is especially important that it be protected carefully and kept free from abuse, that it be inspected regularly and frequently, and that it be changed out well in advance of failure.

Two Important Causes

By Supervisor of Bridges and Buildings

Wear in wire rope is not always given the consideration its importance warrants, as is evidenced by the number of accidents that occur every year as a result of rope failures. On the other hand, while the potential personal hazard is very great, fortunately, the number of personal injuries is less than might be expected, for the men have learned to stay in the clear when heavy lifting is under way.

Lack of proper lubrication is probably the most common cause of wear. Lubrication is as necessary throughout the interior of the rope as on the surface. The reasons for this are that there is relative motion between the strands that make up the rope and, without proper lubrication they will wear, sometimes almost as rapidly as the external strands; while they are generally subject to rather severe corrosion unless the lubricant is of a character that will penetrate the rope and thus protect them.

Another fertile source of wear is the use of sheaves that do not fit the rope. If the groove is too narrow for the diameter of the rope, it will become wedged in and distorted by the groove, with resultant rapid wear not only on the outside strands but on those in the interior. If the groove is too wide, the rope will flatten out, with the same result. Any considerable distortion of a wire rope not only loosens the strands but causes excessive stresses in them and opens the way for rapid deterioration. The diameter of the sheave should be correctly proportioned to the diameter of the rope to insure that there will be no short bending in the latter, as this will cause excessive stresses in the strands and rapid wear.

Inspection should be regular and frequent. The primary use of wire rope is for lifting, and no chances should be taken that may result in personal injury or property damage. The operator of the machine should make a daily inspection and should be responsible for lubrication and the tightness of all clips. Supervisors should inspect the ropes on their equipment whenever they visit the work upon which it is being used. Maintainers, however, should make regular inspections at intervals of 30 days or less, and more frequently if the machine is being used in such a way that this becomes necessary.

Windows in Enginehouses

What practical methods can be employed to reduce breakage of window glass in enginehouses? What is the best arrangement for replacing them?

Difficult to Control

By General Inspector of Buildings

At some engine terminals the breakage of window glass is extremely difficult to control, for the men employed in the servicing and maintenance of the locomotives are sometimes careless and indifferent to the results of this carelessness. Since they are not employed in the department that maintains the building, the officers of this department have little to say about their deportment. To make complaint through regular channels seldom brings any improvement; in fact, relations between the local representatives of the two departments may become strained if this is done.

I have observed that the attitude of the men is reflected by that of the roundhouse foreman. If he is indifferent, the men are sure to be. If he insists on care, the number of broken glass will be reduced. For this reason, when I was on the division, I always had a friendly talk with the foreman, giving him our point of view, explaining our difficulties and showing him the needless expense that was thus saddled on our department and on the road. This usually brought the desired results without any controversy.

In one or two cases where the foremen were recalcitrant, I have gone to the master mechanic and, after explaining our difficulties, have asked for his co-operation. I never failed to receive promises, but did not always get the full measure of co-operation that should have been given. The next step under such circumstances will depend so much on the personalities of those involved, on the type of organization and on the viewpoint of superior officers with respect to the backing they are willing to give, that each case must be handled in the light of these conditions.

At important engine terminals there is usually enough work to require the services of one or more men constantly, and one of these can be delegated to care for the replacement of broken glass. I have sometimes arranged for a man to visit the smaller terminals at approximately regular intervals to look after glazing and other work. It is a good idea to arrange with the enginehouse forces at points where carpenters are not regularly assigned, to replace glass that is broken. Peculiarly enough, where this arrangement has been in effect, the number of broken panes has decreased noticeably. It has not been my custom to replace broken glass during warm weather, but to make a general replacement at the time the windows are gone over just prior to cold weather.

Touches a Sore Point

By Supervisor of Bridges and Buildings

This question touches a sore point with most building foremen and supervisors, for I am sure that there is nothing they have to do with that is so completely out of their control as the breakage of window glass in enginehouses. The enginehouse forces, having no responsibility for replacing broken glass, seldom realize the burden they are putting on the building forces to keep the windows in good repair, or that this work must be done under the most unfavorable conditions of temperature, wind and storms. I have always talked with the roundhouse foreman, but he is generally busy and has little time to give to matters that do not pertain to his own work.

Foremen are generally willing to cooperate but seldom do, principally because they have plenty of troubles of their own, especially during the winter, and the other fellow's troubles are not very impressive to them. How-

ever, where the foreman does cooperate, the amount of broken glass is always less than where they are indifferent, and the best way to reduce glass breakage is to keep working on them continually. I know of no physical means of reducing glass breakage, except to extend the stalls far enough to give considerably more room in front of the pits than is found in the typical enginehouse, and obviously this is not a practical suggestion.

Another scheme that has worked in a few cases but which cannot be applied generally, is to turn the replacement of the broken glass over to the enginehouse forces. Where this has been done there has been a remarkable reduction in the number of broken glass.

I never attempt to replace broken glass in an enginehouse during warm weather, except where the building is in plain view from the main tracks. Early in the fall we go over the windows to put them in condition for winter, at which time we replace all missing glass. At the larger terminals we assign a man to care for the glass during the winter, giving him enough other work to keep him busy. At less important terminals we send a man when we are notified that he is needed, and at one isolated terminal the enginehouse forces have been instructed to make replacements.

Pulling Well Screens

Under what conditions does it become necessary to pull the screen from a deep well? How can this be done?

May Be Difficult

By C. R. Knowles
Superintendent of Water Service, Illinois Central, Chicago

Screens must be removed from deep wells when (1) they become closed through incrustation; (2) sand packs around them preventing the flow of water to them; and (3) corrosion or wear increases the screen openings to the extent that they no longer exclude sand from the well. Pulling a well screen is essentially a fishing job which requires considerable skill and may develop into an extremely difficult one. It is seldom that exactly the same conditions are encountered in the removal of screens from different wells, and ingenuity is sometimes taxed to get them out. The size of the screen, the depth of the well, the character of the water-bearing formation and the age and condition of the screen are all factors that bear on the method to be employed for its removal.

Almost all well screens are originally provided with a bail designed to be used for pulling them from the well. The bail cannot always be used effectively for this purpose, however. This is particularly true where the screen has been weakened through corrosion, as the pressure of the sand around the screen will often cause the weakened wall to collapse when the pull is applied to the bail. In other cases, where the sand is cemented closely around the screen, the bail may break. When the bail breaks in pulling, as it often does, it becomes necessary to make the pull with a fishing tool or other pulling device.

A simple and effective method for removing a screen from a well is to lower a pipe line into the screen and fill between it and the screen with sand or fine gravel. Sand is the best material for this purpose as it is less likely than gravel to damage the screen, particularly when a hard pull is required. Again, there is an advantage in the use of sand, because the pipe can be loosened by washing the sand out with a small washing line if the pull on the screen has been unsuccessful, or it is desired to raise the pulling line from the screen for any other reason. Extreme care must be followed when this method is employed, to avoid allowing the sand or gravel to extend above the top of the screen, as it may lodge between the strainer and the casing, allowing both to be pulled, or it may ruin the line.

Almost any size of pipe may be used with this method, provided it will enter the strainer and leave sufficient room to pack the sand between the line and the strainer wall. However, a 4-in. line is usually large enough to pull any strainer up to 12 in. in diameter. The pulling line should have a fitting of some kind, such as an increaser or a bushing and coupling, on its lower end, of sufficient size almost to fill the strainer. When it has reached the bottom of the screen, the sand or gravel should be poured into the well, and the pipe and screen then jacked out. In most cases the line and screen can be removed by means of a cable after the screen has been loosened with jacks. When pulling a screen, it is a good idea to keep the well filled with water, as the pressure of this water tends to relieve the pressure of the sand against the outside of the strainer and thereby avoid the danger of its being collapsed.

Uses Several Methods

By P. S. Prevey
General Water Inspector, Chicago, Milwaukee, St. Paul & Pacific, Kinsey, Mont.

It becomes necessary to pull a well screen when it becomes so clogged with sand that water cannot pass through it or when the surrounding gravel or sand becomes so filled with fine sediment that the flow of water is completely obstructed. There are more cases of trouble with the surrounding sand and gravel strata than with the screen itself. In either event, however, there is only one remedy, and that is to pull the screen. Where the screen has become plugged, it can be cleaned with acid and replaced. If the water-bearing stratum is giving the trouble, it is feasible to let the gravel come in and then clean out a certain amount of it from the well. This will dispose of much of the fine material. The screen can then be replaced and a surge block employed to take out more of the fine material. In some cases where the accumulation of fine material is not too great, a surge block can be used without taking out the screen, but if it has been in service for a long time it is advisable to take it out and clean it.

We have employed several methods for pulling screens, depending on local conditions. Where the quality of the gravel is known and the water-bearing stratum is not more than 8 to 10 ft. thick, and the top of the screen is equipped with a threaded connection, I would not hesitate to couple onto it with a line of pipe for the purpose of pulling it. Where the stratum is of greater thickness, or if the top of the screen is equipped with a lead packer, I use a cone-shaped piece on the end of a line of pipe slightly smaller than the diameter of the screen. With this method, the cone is lowered to the bottom of the screen and gravel is dropped into the screen until it is "gravel packed," when it will come out as the pipe is pulled. This is the method most commonly employed. Some screens are equipped with a bail in the bottom for pulling. I have tried this method twice and in both cases we pulled the bottom out of the screen and had to resort to the cone method to remove the screen. We have had cases where the screen was so firmly cemented in that it could not be pulled by any method and had to be drilled out. This is very slow and expensive and should be avoided if possible.

PRODUCTS of Manufacturers

New Barco Light Weight "Tytampers"

THE Barco Manufacturing Company, Chicago, has added to its line of portable, one-man, gasoline-engine-driven tie tampers, a new, light weight "tytamper," type K-1, designed to meet a demand for a lighter tamper

Part Cut-away View of the K-1 "Tytamper," Showing Details of Its Assembly

which will strike a somewhat lighter blow than the type TT-2.

The Barco unit tie tampers consist of a tamping tool actuated by an air-cooled, two cycle, single-cylinder gasoline engine, in which a spring-returned piston is propelled downward by the explosion in the combustion chamber, striking an anvil which transmits the blow to the tamping bar. Lubrication is provided by mixing oil with the gasoline, and igniton by means of a dry cell battery, coil, circuit breaker and spark plug. The tampers deliver approximately 1300 blows per minute, and can be supplied with various types of tamping tools.

Although the new type K-1 tamper is similar to the TT-2 in general construction and operation, the tamper is 10 lb. lighter, and the battery and battery box are 13 lb. lighter. A number of new features have been incorporated, most important among these features are the gasoline tank, which consists of a spirally-wound steel tubing encircling the cylinder; a spring retained filler cup over the end of the tube tank which serves both as a cap and a convenient oil measure; the attachment of an improved vibrating coil to the handle in close proximity to the spark plug, thereby lightening the load on the battery; the provision of a smaller, lighter weight streamlined battery box, which contains the 7½ volt dry cell battery, and which can be easily dragged over ties, ballast and rails; the mounting of a circuit breaker on the side of the cylinder, and the installation of a new improved handle-type stop switch.

New Tie-Cutter

A MACHINE to expedite the removal of old ties from track has been developed and is now being put on the market by the Woolery Machine Company, Minneapolis, Minn. This device saws old ties into three pieces by making two cuts just inside the rails so that they may be removed quickly and economically in three pieces without digging or trenching or disturbing the ballast bed.

The machine, which operates on the track, has a pressed steel frame braced with steel and aluminum angles and tubing, and has roller bearing wheels. Power is furnished by a 2 h.p. air-cooled motor, with magneto ignition, a mechanical governor, an oil pump, and a V-belt drive. The saw is a long, tapered, vertical steel blade about 1½ in. wide at the upper end, from which it is suspended, and about 4½ in. wide on the lower or cutting end. The teeth are on the lower end of the blade, and its cutting stroke is adjustable to any width of tie. A saw sharpener is mounted on the frame of the machine ready for use at any time. The entire outfit weighs less than 300 lb. and can easily be removed from the track by two men.

In its operation the machine is attached to the rail by means of clamps which can be applied and released instantly. The saw blade stroke is adjusted, if necessary, for the width of the tie, and the tie is cut in two just inside the rail (gage side) at the edge of the tie plate. The actual time necessary to saw a tie in two with this machine is about 30 seconds. When the tie is cut into three pieces the end pieces can be pried out under the rail with a bar.

In addition to the time and labor saved in removing old ties by this method, it is claimed that a better job of inserting the new ties can be done, because the road bed is not disturbed.

Ties To Be Removed Can Be Cut Through in Approximately 30 Seconds

Lufkin Hook-Ring for Woven Tapes

THE Lufkin Rule Co., Saginaw, Mich., has produced a folding end hook of new pattern for woven tapes, which enables one man to take many measurements unassisted. This hook, which is small and sturdy, is permanently fixed to the tape ring, and has two widely spaced prongs with anchor spurs on each. The spurs grip and hold the tape at the end of a board,

End Sections of Two Tapes Showing the Hook in Open and Closed Positions

pipe, corner of a building, or other similar place, when it is under tension, and also prevent it from losing hold from side sway. The end of the tape releases when tension releases. The hook can be folded flat against the tape ring, so that it does not catch objects or prevent the tape line from being fully wound into the case. Friction holds the hook in position when it is open or closed.

Q & C Sentry Signal

A NEW automatic signal device, known as the Sentry signal, for warning track and bridge gangs of the approach of trains or cars, has been developed by the Q & C Company, New York. This device, which is based on an entirely different principle than the earlier Sentry signal of this company that was described in the March, 1938, issue of *Railway Engineering and Maintenance*, incorporates the latest developments in the electronic field and is capable of protecting one or more tracks simultaneously from one or both directions.

The equipment consists of two portable carrier-frequency transmitters and one receiver, which controls a siren that sounds the warning signal. The transmitters are coupled to the rails at each extremity of the zone to be protected, the length of which is determined by the character of the track and the speed of traffic, while the receiver is coupled to the rails at a point in the vicinity of the gang that is being protected. Six-volt storage batteries are provided for operating the transmitters which superimpose a current of carrier-frequency on the rails from which it is picked up by the receiver located at the site where the gang is working.

As long as the flow of carrier current from the transmitters remains uninterrupted a stick relay in the receiver, which controls the siren, remains open. In normal operation, the wheels of cars or locomotives, passing over the point where the transmitters are coupled to the rails, shunt out the carrier current to the receiver, thereby closing the relay and causing the siren to sound. As long as a train is in the protected zone the siren will continue to operate. After the train has passed the receiver and the gang, the circuit is reset in preparation for the next train by means of a push button, but the resetting of the device is not possible so long as a train is in the protected zone. In this manner provision is made for warning the gang of simultaneous train movements on adjacent tracks.

The frequencies produced by the

View of the Containers; for the Receiver Unit (Left) and the Battery and Siren of the New Q & C Track Sentry

transmitters are said to be well in excess of 100,000 cycles and at a very low amperage. The transmitters and receiver are coupled to the track through reactance tubes having a minimum impedence of 20,000 ohms. This impedence is said to prevent the short-circuiting of track signal circuits but to permit easy passage of the carrier frequencies. In fact numerous track tests of the Sentry signal, which have been conducted under a wide variety of operating conditions, involving both alternating-current and direct-current signal circuits, are said to have shown that it does not in either case interfere with the track signal circuits and their normal operation.

To permit the passage of the carrier current through insulated joints, condensers of appropriate type are incorporated in the Sentry circuit at each insulated joint in the protected zone. It is said that these condensers, while permitting easy passage of the carrier frequencies, in no way interfere with track signal frequencies.

The device is assembled in small portable units which are housed in weather-proof containers that can be used readily by either large or small gangs. It is said that no complicated instructions for operating the device are necessary; it is simply attached to the base of the rails by means of flexible wire leads and clamp terminals. Only one minor adjustment is said to be required, the entire device being controlled by one tumbler key switch which eliminates any possibility that it will be shut off inadvertently. It is pointed out that the use of the Sentry makes possible the diversion of watchmen to more productive activities.

Duff-Norton Bell-Bottom Jack Screws

THE Duff-Norton Manufacturing Company, Pittsburgh, Pa., has developed a complete line of new bell-bottom jack screws, including 38 sizes with lifting capacities ranging from 5 to 36 tons. The new jack screws consist of a solid one-piece base of cast steel with a double-ribbed collar reinforcement for added strength around the threaded area of the casting; a one-piece steel screw with smooth, machine-cut threads of correct pitch, depth and thickness; and a forged steel head surmounted by a drop-forged steel load-supporting top, firmly attached without the use of pins. To reduce load friction and to

A Phantom View of the Jack, Showing Assembly and Construction Details

assure smoother lifting action under loads, without twisting of the jack, the load-supporting top operates on a full complement of chrome-molybdenum steel balls located between the head and the load-supporting top in a grease-packed channel.

NEWS of the Month

More Cars Air-Conditioned

In the year ended July 1, 1938, the Class 1 railroads and the Pullman Company air-conditioned 1,384 passenger cars, according to the Association of American Railroads, bringing the total number of air-conditioned passenger cars in operation on that date up to 10,803.

5,700,000 Tons of Scrap Sold by Railroads in 1937

The railroads sold 5,700,000 tons, or approximately 100,000 carloads, of scrap in 1937 for $68,000,000. The largest item was scrap converted into No. 1 melting steel, which amounted to 48 per cent of the total, and old rails were next, amounting to approximately 20 per cent.

Base Price Minimum on Rails Reduced to 200 Tons

On September 1, the Inland Steel Company reduced from 500 to 200 tons the minimum order it will accept at the base price for rails. It is expected that other mills will take similar action, thus reducing the minimum amount a company must order to avoid paying extras. This change is considered more in keeping with present day conditions and will directly benefit the railroads.

Ask To Ban Illinois Trucks On Holidays and Weekends

The governor of Illinois has been requested by the Brotherhood of Railroad Trainmen to ban heavy trucks from highways on weekends and holidays in the interest of safety. A bill with this objective was killed at the last regular session of the Illinois legislature. Another bill asking that the legal load limit for trucks be reduced from 40,000 lb. to a maximum of 30,000 lb. will be requested by the brotherhood in the next general assembly.

Plans on Abandonment of Q. O. & K. C. Are Changed

The proposed plan for complete abandonment of the 249 miles of the Quincy, Omaha & Kansas City, which was reported in the June issue, has been changed and now provides for the abandonment of 145 miles between Milan, Mo., and Kansas City, and the acquisition of the remaining 104 miles of line between Milan and Quincy, Ill., by the Chicago, Burlington & Quincy. It is believed that the operation of this portion as a branch line of the Burlington may earn expenses. Concerning the remainder, Ralph Budd, president of the Burlington, said that operation is absolutely hopeless.

Cotton Belt Truck Lines Lead in Safety

The Southwestern Transportation Company, trucking subsidiary of the St. Louis Southwestern, has won either first or second prize during the last four years in the national safety contest conducted by the National Safety Council, winning first prize in two of these years and second prize in the other two years. The favorable record established by this company is due primarily to a comprehensive safety program, of which some of the principal features are the careful selection and thorough training of its truck drivers; a bonus plan whereby drivers who maintain records without accidents receive periodical increases in pay; and careful inspection and maintenance of equipment.

Shipstead Car Rental Plan

A plan under which the railroads would sell for scrap 300,000 obsolete freight cars, and buy from the government on an installment payment plan 300,000 new and modern cars has been advocated by Senator Shipstead, Farmer-Laborite of Minnesota. The cost of the new cars is estimated by Senator Shipstead at $700,000,000. In summarizing his plan he stated that it would create a tremendous buying power by causing a total turnover of approximately $7,000,000,000, insure extensive re-employment, pay workers $500,000,000 in initial wages, save the railroads $30,000,000 annually, solve one major rail problem, be self-liquidating, securely financed and use 20,000,000 tons of raw materials.

Rail-Bus Co-ordination on the Bangor & Aroostook

The Bangor & Aroostook Transportation Company, a wholly-owned subsidiary of the Bangor & Aroostook Railroad, is furnishing a co-ordinated rail-bus service in Northern Maine, which differs from the usual type of such operations. Due to severe climatic conditions in the winter, and heavy tourist travel in the summer, the demand from December to May is for local bus service, while for the remaining months of the year, the local service is not needed, and through service, intended largely for tourist travel, is established in conjunction with regular train service. The Bangor & Aroostook also provides another unique service in the form of canoe-rail trips, with a choice of many routes of various lengths ranging from 99 to 231 miles.

Traffic Man "Loaned" to Rutland Railroad

Through the efforts of the Rutland Railroad Co-operating Traffic Association, R. F. Bohman, of Gardner, Mass., traffic expert of the Heywood Company, has been "loaned" to the Rutland railroad as its chief traffic officer. The salary and expenses of Mr. Bohman will be paid by the association. Other recent developments on this road include the appropriation of a $3000 fund by the State Emergency Board of Vermont for the employment of experts to study railroad problems of the state, with particular reference to those of the Rutland, and an open letter issued by L. G. Morphy, receiver of the Rutland, to all employes soliciting co-operation and suggestions for more economical and efficient operation, and requesting the active help of the employes in securing traffic for the road.

Passenger Travel on the "Daylight" Increases

On the first anniversary of the "Daylight" on March 21, as reported by the Railway Age on May 14, the Southern Pacific claimed this train to be the world's most heavily patronized one-section, long-distance daily train. Since that time, and especially since July 1, when a 1½-cent fare went into effect, increased traffic has forced this company to run extra sections of this train. Seven such extra sections were run in the month of June, 25 in July, and 52 in August. The total traffic from March 21, 1937, when the train was installed, to August 31 of this year, has been 384,592 persons, 191,012 handled southbound and 193,580 northbound. In July and August of this year, the average number of passengers carried by this train has totaled 1013 daily, an average of 508 southbound and 505 northbound, as compared with an average total of 695 passengers carried daily in both directions during the first 12 months of this train's operation.

Personal Mention

General

R. W. Clifton, Jr., roadmaster on the Norfolk & Western, with headquarters at Wilcoe, W. Va., has been appointed assistant yardmaster of the Auville Yard.

B. F. Beckman, chief engineer of the Fort Smith & Western, has been appointed also superintendent in charge of the transportation and mechanical departments.

Engineering

W. J. Strout, superintendent of bridges and buildings of the Bangor & Aroostook, with headquarters at Houlton, Me., has been appointed assistant engineer in the chief engineer's office, with the same headquarters, effective September 1.

P. X. Geary, assistant division engineer of the Maryland division of the Pennsylvania, has been appointed acting engineer of the Washington (D.C.) Terminal Company. **F. P. Filippelli,** supervisor on the Maryland division of the Pennsylvania, has been promoted to assistant division engineer on the same division to succeed Mr. Geary.

F. O. Condon, acting regional chief engineer of the Atlantic region of the Canadian National, with headquarters at Moncton, N.B., has been appointed regional chief engineer at the same point. He replaces **H. T. Hazen,** whose retirement early this year was reported in the February issue. Mr. Condon was born at Moncton and was educated in the public schools of that city. On February 14, 1893, he joined the Intercolonial Railway (Canadian National) at Moncton as a messenger in the engineering department. He was appointed a draftsman in October, 1899, and on April 1, 1912, he was advanced to division engineer. In the following year he was appointed resident engineer at Campbellton, N.B., returning to Moncton on January 1, 1916, as division engineer. On March 3, 1923, he was appointed engineer maintenance of way, and on November 15, 1927, he became principal assistant engineer. Mr. Condon was appointed office engineer on September 1, 1932, and held that position until January of this year, when he was appointed acting regional chief engineer.

F. O. Condon

John A. MacKenzie, division engineer of the Trenton division of the Canadian Pacific, with headquarters at Toronto, Ont., has been appointed assistant engineer maintenance of way of the Eastern lines, with the same headquarters, to succeed **Nelson E. Gutelius,** deceased. **J. J. Richardson,** assistant engineer in the maintenance of way department of the Eastern lines, with headquarters at Toronto, has been promoted to division engineer of the Trenton division, to succeed Mr. MacKenzie. **W. R. Benny,** transitman at Smiths Falls, Ont., has been appointed assistant engineer in the maintenance of way department at Toronto, to succeed Mr. Richardson.

Mr. MacKenzie was born on January 11, 1889, at Cornwall, Ont., and was educated at the Royal Military college, Kingston, Ont. During the early part of his career, Mr. MacKenzie served in various engineering capacities with a number of railways, power companies and contractors, and also served overseas during the World War. He entered the service of the Canadian Pacific in May, 1922, as a transitman on the Brownville division, later being transferred to the London division. In July, 1929, he was advanced to division engineer of the Montreal terminals. Two years later he was appointed roadmaster, in which capacity he served on various subdivisions. In November, 1933, he was re-appointed to the position of division engineer, this time of the Trenton division, where he was located at the time of his recent appointment as assistant engineer maintenance of way of the Eastern lines.

Mr. Richardson has been identified with the Canadian Pacific for more than 25 years, having entered the service of this company in June, 1913, as assistant building inspector at Sudbury, Ont. In January, 1927, he was appointed yard foreman at Schreiber, Ont., where he was advanced to transitman in May, 1935. Since May 16 of this year he had served as assistant engineer in the maintenance of way department of the Eastern lines at Toronto.

James C. Irwin, valuation engineer of the Boston & Albany, with headquarters at Boston, Mass., has retired, effective September 30, after 46 years of service with the New York Central System of which the B. & A. is a part. Mr. Irwin was born on September 23, 1868, at Cheyney, Pa., and was educated at the University of Pennsylvania, receiving a Batchelor of Science degree in 1890 and that of Civil Engineer in 1891. He entered the service of the New York Central in 1892 on signal construction work on the Mohawk division. In the following year, he was appointed an assistant trainmaster, and from 1894 to 1898, he served as superintendent of the Hudson River bridge territory and as assistant superintendent of signals of the Mohawk division. He then became division engineer of the Middle division, and from 1902 to 1903 he served as engineer of signals and assistant to general superintendent. During the ensuing three years, Mr. Irwin was attached to the staff of the vice-president of construction, and from 1906 to 1909, he served as superintendent of construction in the Electrified zone and as resident engineer on the construction of the Grand Central terminal at New York. At the end of this period he became chief engineer of the Rutland, leaving this company in 1912 to go with the Boston & Albany as assistant engineer. Two years later, he was promoted to valuation engineer, which position he held until his retirement. For many years, Mr. Irwin has been active in the affairs of the American Railway Engineering Association and served as president of this organization in 1937-38. He has also served as a director and member of the Standards council of the American Standards Association and as president of the New England Railroad Club.

James C. Irwin

Track

Andrew Ibson, roadmaster on the Chicago, Burlington & Quincy, with headquarters at Central City, Neb., retired October 1.

A. D. Derrough, general foreman on the Pere Marquette, has been promoted to track supervisor, with headquarters at St. Thomas, Ont.

W. Waters, instrumentman on the Canadian National at Regina, Sask., has been appointed acting roadmaster with the same headquarters, succeeding **J. A. Pennock,** who has retired.

A. M. Loveless, section foreman on the Chicago & Eastern Illinois, at Terre Haute, Ind., has been promoted to track supervisor with headquarters at Chicago Heights, Ill., succeeding **L. Coffel,** who has retired.

N. G. Schumaker, section and extra gang foreman on the Chicago, Milwaukee, St. Paul & Pacific at Hilbert, Wis., has been promoted to roadmaster, with headquarters at Channing, Mich., replacing **Dan W. Loftus,** who has been transferred to Perry, Iowa, to succeed **J. A. Cherwinker,** deceased. **Leo Cross,** sec-

tion and extra gang foreman at Perry, Iowa, has been promoted to roadmaster, with headquarters at La Crosse, Wis., relieving **E. A. Whitman,** who has been assigned to other duties.

A. Peterson, roadmaster on the Canadian National, with headquarters at Cochrane, Ont., has been transferred to Hamilton, Ont., and **E. L. Latimore** has been appointed roadmaster at Cochrane, succeeding Mr. Peterson.

Leo C. Smith, instrumentman in the engineering department of the Chicago & North Western at Sioux City, Iowa, has been promoted to roadmaster, with headquarters at Eagle Grove, Iowa, succeeding **A. J. Weise,** who retired October 1.

J. A. Trainer, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Enid, Okla., who has been off duty on account of illness, has returned to work, displacing Steve Robertson, who has returned to his former duties as track supervisor at Enid.

Ed Mingus, track supervisor on the Chicago, Rock Island & Pacific, with territory from El Reno, Okla., to Seminole, has been appointed acting roadmaster at Haileyville, Okla., succeeding **G. M. Brum,** who has been placed in charge of the removal of the Ardmore line.

H. B. McColgan, assistant roadmaster on the Norfolk & Western, with headquarters at Portsmouth, Ohio, has been promoted to roadmaster, with headquarters at Wilcoe, W. Va., succeeding **R. W. Clifton, Jr.,** whose appointment as assistant yardmaster is reported elsewhere in these columns. **J. E. Dailey,** assistant roadmaster on the Pulaski district, of the Radford division, has been transferred to Portsmouth, replacing Mr. McColgan, and **D. K. Wickham,** electric welder in the maintenance of way department, has been promoted to assistant roadmaster, relieving Mr. Dailey.

W. C. Gretzinger, assistant supervisor on the Philadelphia Terminal division of the Pennsylvania, has been promoted to supervisor on the Wilkes-Barre division, with headquarters at Reading, Pa., succeeding **E. R. Schultz,** who has been transferred to the Philadelphia division, with headquarters at Lancaster, Pa. Mr. Schultz succeeds **M. C. Bitner,** who has been transferred to the Maryland division, with headquarters at Baltimore, Md., replacing **F. P. Filippelli,** whose appointment as assistant division engineer is noted elsewhere in these columns.

O. C. Woods, section foreman on the Chicago, Rock Island & Pacific at Addington, Okla., has been promoted to track supervisor on the Southern division, with territory between Bridgeport, Tex., and Comanche, Okla., succeeding **A. J. Lewis,** who has been transferred to Booneville, Ark., with territory from Booneville, to Bigelow, Ark., replacing **J. F. Frame,** who has been assigned to other duties. **W. G. Norris,** section foreman at Liberal, Kan., has been promoted to track supervisor with headquarters at Dalhart, Tex., relieving **John Burns,** who has been transferred to Trenton, Mo., to succeed **Lee Hill,** who has been transferred to Colorado Springs, Colo.

J. F. Cooper, draftsman in the engineering department of the Canadian National at Winnipeg, Man., has been promoted to acting roadmaster of the Cromer and Carlye subdivisions, Portage-Brandon division, Manitoba district, with headquarters at Brandon, Man., succeeding **H. H. Leathers,** who retired August 9.

Mr. Leathers was born at Diss, Norfolk, England, on September 23, 1873, and entered railway service on May 1, 1902, as a section laborer at Roland, Man. After service as a section foreman and relieving roadmaster, he was promoted to roadmaster on the Canadian National, with headquarters at The Pas, Man., on April 15, 1931, and later served as roadmaster at Portage La Prairie, Man., and Brandon until his recent retirement.

Alexander Eremko, whose promotion to roadmaster on the Canadian Pacific, with headquarters at Estevan, Sask., was reported in the September issue, was born in Austria on July 19, 1889, and entered the service of the Canadian Pacific on May 10, 1908, as a section laborer. On December 23, 1910, he was promoted to section foreman at Saltcoats, Sask., and on September 9, 1915, he was transferred to Yorktown, Sask. He later became section foreman at Wynyard, Sask., the position he held at the time of his recent promotion.

C. M. Martin, acting roadmaster on the Canadian National, with headquarters at Hamilton, Ont., has been promoted to roadmaster at that point succeeding **Abel Grills,** who has retired. Mr. Grills, who was born near Lindsay, Ont., on June 18, 1873, entered the service of the Grand Trunk (now a part of the Canadian National) as a trackman at Manila Junction, Ont., on May 1, 1891. He worked as a sectionman at Argyle, Ont., Cameron, and Lindsay, and in 1898, he was an extra gang foreman at Fort Erie, Ont., and Lucknow. On July 1, 1903, he was promoted to roadmaster at Sarnia, Ont., and in October, 1905, he was transferred to Hamilton. On January 1, 1909, he was transferred to St. Thomas, Ont., and on July 1, 1917, he was advanced to general roadmaster. In December of 1920, he was again appointed roadmaster at Hamilton, the position he held until his retirement. Mr. Grills was president of the Roadmaster's and Maintenance of Way Association in 1918.

C. C. Mullen, assistant to roadmaster on the Southern, with headquarters at Somerset, Ky., has been promoted to track supervisor, with headquarters at Huntingburg, Ind., succeeding **L. Woodall, Jr.,** who has been transferred to East St. Louis, Ill., replacing **Harvey Knight,** who retired July 31. **John P. Mumford,** assistant supervisor of bridges and buildings at Birmingham, Ala., has been promoted to track supervisor at Dayton, Tenn., succeeding **R. J. Stone,** who has been transferred to Oakdale, Tenn., replacing **W. C. Morris,** who, in turn, has been transferred to Somerset, Ky., relieving **C. Trusty,** who retired on August 31. **S. T. Montgomery,** assistant supervisor on the St. Louis-Louisville division, with headquarters at Princeton, Ind., has been appointed assistant to roadmaster, at Somerset, Ky., succeeding **W. F. Smock,** whose promotion to assistant supervisor of bridges and buildings is noted elsewhere in these columns, and **C. I. Parsons,** assistant supervisor of bridges and buildings at Hattiesburg, Miss., has been promoted to assistant supervisor at Princeton, Ind., replacing Mr. Montgomery.

E. R. Murphy, assistant supervisor of track of Subdivision No. 9 of the Syracuse division of the New York Central, with headquarters at Syracuse, N.Y., has been promoted to supervisor of track of Subdivision No. 32 of the St. Lawrence division, with headquarters at Malone, N.Y., effective September 1, succeeding **J. F. Welch,** who has retired. **J. E. Spangler,** transitman on the engineering corps, has been promoted to assistant supervisor of track at Syracuse, to succeed Mr. Murphy.

Mr. Murphy was born on June 11, 1900, at Syracuse and was educated in civil engineering at Clarkson college. He first entered railway service with the New York Central on July 17, 1919, as a chainman at Albany, N.Y. On April 16, 1920, he was promoted to rodman, with headquarters at Utica, N.Y., and on April 1, 1923, he was further advanced to transitman, with the same headquarters. Four years later, he was promoted to assistant supervisor of track, with headquarters at Charlotte, N.Y., later being transferred to Syracuse, where he was located at the time of his recent appointment.

Mr. Welch was born on February 26, 1872, and entered the service of the New York Central at the age of 20 years as a boilermaker helper. In the following year, he was transferred to the maintenance of way department where he was promoted to section foreman in 1898. Four years later, he was further advanced to assistant supervisor of track and in 1909, he was made supervisor of track, with headquarters at Malone, where he was located until his retirement.

Bridge and Building

J. W. Wiggins has been appointed acting superintendent of bridges and buildings of the Bangor & Aroostook, with headquarters at Houlton, Me., to succeed **W. J. Strout,** whose appointment as assistant engineer is noted elsewhere in these columns.

Leslie R. Pennington, assistant supervisor of bridges and buildings on the Black Hills and Wyoming division of the Chicago & North Western, has been promoted to acting supervisor of bridges and buildings, with headquarters at Pierre, S.D., succeeding **James R. Hartwell,** who retired September 1.

W. F. Smock, assistant to the roadmaster on the Southern, with headquarters at Somerset, Ky., has been promoted to assistant supervisor of bridges and buildings with headquarters at Birmingham, Ala., succeeding **John P. Mumford,** whose promotion to track supervisor is noted elsewhere in these columns. **V. E. Williams,** student apprentice, has been promoted to assistant supervisor of bridges and buildings at Hattiesburg, Miss., relieving **C. I. Parsons,** whose pro-

motion to assistant supervisor is also reported elsewhere in this issue.

Obituary

Daniel E. Lynch, roadmaster on the Chicago, Burlington & Quincy, with headquarters at Sheridan, Wyo., died of a heart attack on September 15. Mr. Lynch was born at West Branch, Iowa, on January 30, 1870, and entered railway service on the Burlington, Cedar Rapids & Northern (now a part of the Chicago, Rock Island & Pacific) as a section laborer. He later served successively on the B. C. R. & N. as a section foreman, yard foreman, extra gang and construction foreman, work train conductor and roadmaster. On September 1, 1906, he went with the Chicago, Burlington & Quincy as roadmaster on the Alliance division, and in September, 1912, he was transferred to the McCook division. Mr. Lynch was transferred to the Sheridan division on February 1, 1921.

J. A. Cherwinker, roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Perry, Iowa, died on August 30. Mr. Cherwinker was born at Chamberlin, N.D., on June 26, 1889, and entered railway service as a section laborer on the Milwaukee on October 13, 1903. He was promoted to assistant extra gang foreman on April 11, 1909, and to extra gang foreman on June 30, 1909. He later served as a section foreman and extra gang foreman on rail laying and surfacing gangs on the Kansas City and Chicago Terminal divisions, and in October, 1924, he was promoted to roadmaster of the Iowa division branch lines, with headquarters at Monticello, Iowa. Mr. Cherwinker was transferred to Perry in the spring of 1925, and remained at that location until his death.

Albert Bruce Campbell, whose retirement on account of ill health as roadmaster on the Chicago, Burlington & Quincy, with headquarters at Lincoln, Neb., was reported in the August issue, died at Lincoln, on September 5. Mr. Campbell was born at McCook, Neb., on July 12, 1886, and entered the service of the Burlington on November 14, 1906, as a clerk in the superintendent's office at McCook. In March, 1909, he became an extra gang timekeeper, and later became an assistant foreman and an assistant extra gang foreman. In 1911, he was promoted to section foreman on the Sterling division, and on July 15, 1913, he was advanced to roadmaster on the Sheridan division. Mr. Campbell was transferred to the Casper division in 1915, and to the Lincoln division, with headquarters at Lincoln in 1921, where he served until his retirement.

L. A. Murr, formerly district engineer of the Seaboard Air Line, died on August 18, at the age of 53 years. Mr. Murr was educated at North Carolina College of Agriculture and Engineering, graduating in 1905. Early in his career he served for a short time as a member of the engineering department of the city of Greensboro, N.C. Subsequently he entered the service of the Seaboard Air Line as a resident engineer on construction, later being appointed assistant engineer. In 1920, he was further promoted to district engineer but after about a year in this capacity, he left the S.A.L. to enter contracting work. Several years later he returned to the railroad as assistant engineer, again leaving after a few years service. He again engaged in contracting work and in 1930 joined the United States Engineers as an assistant engineer.

Nelson E. Gutelius, assistant engineer maintenance of way of the Canadian Pacific, with headquarters at Toronto, Ont., who died on July 30, as reported in the September issue, was a native of London,

Nelson E. Gutelius

Ont., where he was born on April 15, 1884. Mr. Gutelius entered railway service with the Canadian Pacific on October 30, 1907. On December 15, 1912, he became a resident engineer at Montreal, Que., later serving in the same capacity at Brownville Junction, Que., Sudbury, Ont., and North Bay, Ont. On March 15, 1920, he was appointed assistant engineer, with headquarters at Montreal. Nine years later he was transferred to maintenance of way work on the Eastern lines with the same title and with the same headquarters. On May 1, 1937, Mr. Gutelius was advanced to assistant engineer maintenance of way of the Eastern lines, with headquarters at Toronto, which position he held until his death.

Levi B. Lincoln, principal assistant engineer of the Bangor & Aroostook, with headquarters at Houlton, Me., whose death on August 18, was reported in the September issue was born on February 5, 1875, at Augusta, Me. Mr. Lincoln was educated at Hebron academy and at the University of Vermont, and spent the early years of his career with various railroads and on fortification work at the harbor at Portland, Me. From 1901 to 1907, he served as a resident engineer on the location and construction of the Portland, Rumford Falls & Rangley Lakes and the Portland & Rumford Falls (now parts of the Maine Central). At the end of this period he went to California and for a time engaged in railroad work there. In 1909, he entered the service of the Bangor & Aroostook as a locating and construction engineer, being advanced to division engineer in 1912. In 1914 he was promoted to valuation engineer and then became, successively, corporate engineer and principal engineer, holding the latter title at the time of his death.

Association News

Railway Tie Association

Members of the Executive committee met at Memphis, Tenn., on September 12, to formulate plans for a more active program for the organization, including the expansion of its committee activities.

Wood Preservers Association

A meeting of the Executive committee will be held at the Hotel Stevens, Chicago, on October 18, to complete final plans for the convention which will be held in Washington, D.C., on January 24-26, 1939.

Maintenance of Way Club of Chicago

The club will hold the first meeting of its 1938-1939 season at the Auditorium Hotel, on Monday night, October 24. Other than the usual dinner at 6:30 p.m., the program for this meeting has not been fully arranged, and, therefore, cannot be announced at this time.

Metropolitan Track Supervisors Club

The first fall meeting of the club will be held at the Hotel McAlpin, New York, on October 20. Following dinner, which will be served at 6:30 p.m., J. G. Hartley, assistant engineer, Pennsylvania, will speak on "Methods of Elimination of Rail Corrugation." Members are urged to attend this meeting to vote on a matter of special importance.

American Railway Engineering Association

Shortly after the first of the month, the secretary's office will mail to the membership of the association the September-October Bulletin No. 405, and, during the first half of the month it expects to be able to send to holders of the Manual the loose-leaf supplements to the Manual, which have now been approved by the Association of American Railroads.

During the month of October, the secretary expects to receive final reports from the following six committees, for publication in the November Bulletin No. 406, and for subsequent presentation at the convention next March: Standardization; Signals and Interlocking; Electricity; Clearances; Economics of Railway Location and Operation; and Uniform General Contract Forms.

Nine committees held meetings during September, several in connection with the convention of the Roadmasters and Maintenance of Way Association, at Chicago, on September 20-22. These committees were as follows: Water Service, Fire Protection and Sanitation, at Chicago, on September 8; Uniform General Contract Forms, at New York, on September 12; Waterproofing of Railway

Structures, at New York, on September 13; Maintenance of Way Work Equipment, at Chicago, on September 19-20; Track, at Chicago, on September 20; Roadway and Ballast, at Chicago, on September 20; Economics of Railway Labor, at Chicago, on September 21; Rail, at Chicago, on September 21; and Yards and Terminals, at Harrisburg, Pa., on September 26-27.

Seven committees have scheduled meetings for October, these committees, together with the dates and locations of their meetings being as follows: Highways, at Chicago, on October 4; Economics of Railway Location and Operation, at Ann Arbor, Mich., on October 6-7; Iron and Steel Structures, at Washington, D.C., on October 6-7; Water Service, Fire Protection and Sanitation, at Chicago, on October 19; Wood Preservation, at Chicago, on October 19; Buildings, at Chicago, on October 19-20; and Economics of Railway Labor, at Birmingham, Ala., on October 27, in connection with an inspection trip over the L. & N., completing the meeting at New Orleans, La.

Bridge and Building Association

Plans for the forty-fifth annual convention at the Hotel Stevens, Chicago, on October 18-20, are now practically completed. All of the committees have completed their work and their reports are now in the hands of the secretary. The interest that is being displayed indicates a large attendance and a successful convention. The program is as follows:

Tuesday, October 18
Morning Session

Convention called to order.
Greetings from the American Railway Engineering Association, F. E. Morrow, President.
Greetings from the American Association of Railroad Superintendents, W. L. Fox, President.
Greetings from the Roadmasters and Maintenance of Way Association, A. H. Peterson, President.
Address by C. Miles Burpee, President.
Appointment of Special Committees.
Report of Committee on Meeting Today's Demands with Cranes and Pile Drivers; O. W. Stephens, Chairman (track supervisor, D. & H., Oneonta, N.Y.).

Tuesday Afternoon

Report of Committee on Recent Developments in Field Methods in the Construction of Timber Trestles; A. S. Krefting, Chairman (assistant engineer, M. St. P. & S. S. M., Minneapolis, Minn.).
Address on Lessons to Be Learned from Recent Bridge Failures, by R. A. Van Ness, bridge engineer, A. T. & S. F. System, Chicago.
Report of Committee on The Maintenance of Movable Bridges; A. E. Bechtelheimer, Chairman (assistant bridge engineer, C. & N. W., Chicago).

Wednesday, October 19
Morning Session

Report of Committee on Pipe Lines for Railway Water Service; R. E. Dove, Chairman (assistant engineer, C. M. St. P. & P., Chicago).
Address on Safety in These Days of Reduced Forces, by J. E. Long, superintendent of safety, D. & H., Albany, N.Y.
Report of Committee on The Maintenance of Cinder Pits; C. A. J. Richards, Chairman (master carpenter, Penna., Chicago).
Annual Luncheon.

Wednesday Afternoon

Report of Committee on The Insulation of Railway Buildings; N. D. Howard, Chairman (managing editor, *Railway Engineering and Maintenance*, Chicago)
Address on Current Trends in the Design of Railway Buildings.
Report of Committee on The Inspection and Preparation of Wood Surfaces for Painting; T. D. Saunders, Chairman (assistant division engineer, C. N. R., Toronto, Ont.).

Wednesday Evening

Annual Dinner.

Thursday, October 20
Morning Session

Report of Committee on The Possibilities and Limitations of the Acetylene Cutting Torch; J. L. Varker, Chairman (bridge and building supervisor, D. & H., Carbondale, Pa.).
Business session.
Report of officers and of committees.
Election of officers.
Selection of 1939 convention city.
New business.
Installation of officers.

Thursday Afternoon

Inspection of the Underwriter's Laboratory, to witness demonstrations of fire tests and observe measures to reduce hazards of fire and personal injury in industry.

Supply Trade News

General

The United States Gypsum Company, Chicago, plans the purchase of a mill site and the construction of a modern plant at Jacksonville, Fla.

The stockholders of the **National Lumber and Creosoting Company,** Texarkana, Ark., a subsidiary of **The Wood Preserving Corporation,** Pittsburgh, Pa., with plants at Texarkana and Houston, Tex., have approved the dissolution of The National Company and the transfer of its properties to the parent company. All operations of National Lumber will hereafter be conducted by the Wood Preserving Corporation.

The Railroad Products Company, Cincinnati, Ohio, has purchased the facilities, patents and trademark rights of the **American Valve & Meter Company,** Cincinnati, used in the manufacture and sale of the Poage water column, standpipe, water hammer eliminator, float valve, tank valve, tank fixtures and stock drenchers; and Economy switch stands, Duro switch stands, Anderson switch interlockers and safety switch locks, Buckeye switch stands and Rapid Rail Joint clamps. **John T. McGarry,** formerly associated with the American Valve & Meter Company, has been appointed general manager of the Railroad Products Co.

Personal

Arthur James Manson has been appointed transportation sales manager of the **Westinghouse Electric & Manufacturing Co.,** with headquarters at Pittsburgh, Pa. Ralph Kelly, vice-president of Westinghouse, announced the appointment after the recent consolidation of the transportation and generator divisions of the company. Mr. Manson was born at

Arthur James Manson

Scituate, Mass., was educated in the Boston public schools and was graduated from Massachusetts Institute of Technology in 1905. The same year he entered the student's course at Westinghouse. His engineering assignments included the electrification of the Pennsylvania Railroad tunnel in New York City and the electrification of the Long Island, the Norfolk & Western and other lines. In 1912 Mr. Manson became a special railway salesman for Westinghouse in New York and eight years later was appointed manager of the transportation division. In 1924 he was appointed manager of the heavy traction section at East Pittsburgh, Pa., and in 1931 he became assistant sales manager of the transportation department. Last November, Mr. Manson was appointed manager of the transportation division.

Obituary

Edward Capouch, contracting manager of the American Bridge Company, with headquarters at Chicago, died August 28.

C. Parker Holt, vice-president and a director of the Caterpillar Tractor Company, Peoria, Ill., died on August 24 at Piedmont, Cal.

George D. Bassett, retired manager of the railroad department of the **H. Channon Company,** Chicago, and formerly vice-president of **Crerar, Adams & Company,** Chicago, died on September 10 at West Chicago, Ill.

A large number of "off-track" jobs can be done more economically and efficiently by International TracTracTors. Here is a Model T-40 doing a typical job faster and at lower cost than former methods.

Bank on the Reputation of INTERNATIONAL TracTracTors

Great working capacity, low-cost operation and maintenance, long life—these make investment in International TracTracTors unusually profitable for "off-track" work. The tougher the job the greater the need for these powerful crawler tractors. They are International Harvester *quality* products, engineered in every detail to give *plus* performance and to cut costs to the bone.

Solve the problem of cleaning ditches, banks, culverts, and under trestles and bridges; pulling ties; moving tracks; replacing rails; building grades and re-shouldering slopes; digging holes and setting posts; plowing fire breaks; and many other jobs with TracTracTors. They are available in five different models for gasoline and Diesel operation. Ask the nearby International industrial dealer or Company-owned branch for a demonstration and complete information.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
180 North Michigan Avenue Chicago, Illinois

INTERNATIONAL Industrial Power

TO RAILWAY SUPPLY MANUFACTURERS

"Out on the Line"

"Bill, why is it that they're not using our material on the ..... division of the Missouri Pacific? Aren't you calling on the division engineer?" asked the sales manager of a railway supply company.

"I'm trying to, boss, but I'm not having any luck," replied the district sales representative.

"Any luck! What do you mean?"

"I mean this, boss. You know that I don't get down to Texas more than twice a year and when I do get there, I can't ever find him."

"Doesn't he have an office?"

"Certainly he does, but his work is out on the line and that's where he spends his time."

"Why don't you follow him out on the line?"

"I tried that too, but he is on the go continually and I have wasted a lot of time trying to catch up with him. I did meet him in the field the last time that I was down there, but he was on a motor car making an inspection with his roadmaster and bridge supervisor and I couldn't discuss our material with him in any detail under those conditions."

"How can we get our story over with him?"

"That's what I asked his chief clerk."

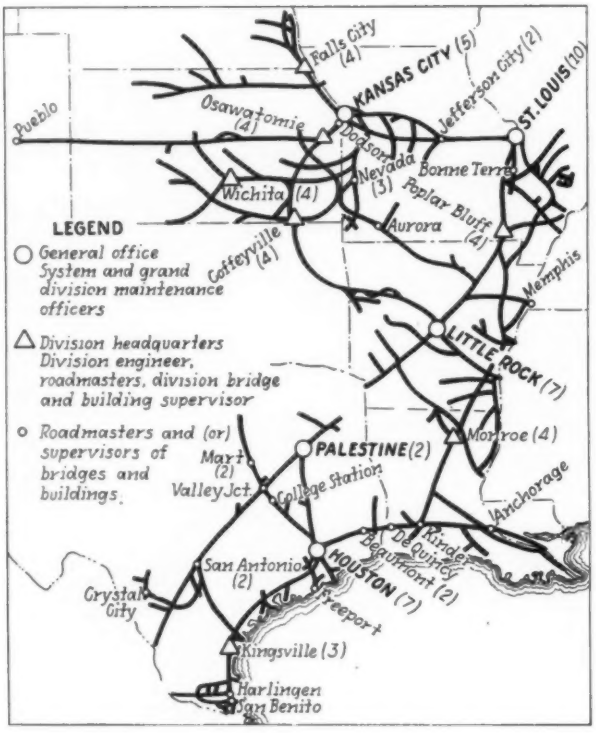
"What did he say?"

"Boss, he asked me why we didn't advertise in Railway Engineering and Maintenance like the ..... Company does. He said his chief gets this paper every month and takes it home with him where he reads it from cover to cover, including the ads, while at ease and with sufficient time. His chief clerk also said that he takes it out on the line with him and discusses things he sees in it with his supervisors and his more alert foremen. You know that these men also get that paper."

"You mean that you think that we could reach this man *every month* through a regular campaign of advertising in Railway Engineering and Maintenance?" asked the sales manager.

"That's the suggestion his chief clerk made," replied the sales representative, "and I think he's right."

"I believe he is too. We'll try it."



Railway Engineering and Maintenance Goes Every Month to 84 Supervisory Maintenance Officers on the Missouri Pacific Lines at **4 General Offices, 7 Division Headquarters and 20 Other Roadmasters and Supervisors Headquarters,** Scattered All the Way from St. Louis, Mo., and Falls City, Neb., to San Benito, Tex. This Magazine Also Goes to 109 Other Subordinate Officers Who Are in Training for Promotion to Supervisory Positions on These Lines.

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

ALPHABETICAL INDEX TO ADVERTISERS
and list of their products

(Continued on next page)

Industrial Brownhoist 661
Bay City, Michigan.
Buckets, Clamshell, Grab; Combination Crane Pile Drivers; Cranes, Crawler, Electric Gantry, Locomotive, Magnet, Pillar, Transfer Tunnel, Wharf, Wrecking; Ditchers, Drainage, Draglines; Excavators; Hammers, Pile Driving, Steam; Pile Drivers; Tools, Wrecking; Transfer Tables.

Ingersoll-Rand 574
11 Broadway, New York City.
Air Compressors; Air Hoists; Air Lift Pumping System; Chipping Hammers; Compressors; Condensers; Hammers; Chipping, Calking, Riveting, Rock Sealing; Hose; Pavement Breakers; Pneumatic Tools; Portable Grinders; Rail Bonding Outfits; Screw Spike Drivers; Tie Tampers.

Ingot Iron Railway Products Company 594
Middletown, Ohio.
Asbestos Bonded Pipe; Automatic Drain Gates; Bin-Type Retaining Walls; Culverts; Metal Cribbing; Multi-Plate Pipe; Paved Invert Pipe; Part Circle Culverts; Perforated Pipe; Pile Shells; Sheet Piling; Steel Roof Decks; Structural Steel Plate Lining.

International Harvester Company, Inc. 659
180 North Michigan Avenue, Chicago, Illinois.
Tractors; Trucks.

Koppers Company 589-590
Pittsburgh, Pennsylvania.
Castings, Bronze and Iron; Coal; Coal Handling Plants; Coal Washing Systems; Coke; Creosote; Disinfectants; Fire Hydrants; Insecticides; Paving; Paints, Bituminous Base; Pipe; Pressure Treated Poles, Posts, Ties, Treated Timber; Rings, Packing, Piston; Roofing; Tanks; Waterproofing; Weed Killers.

Lufkin Rule Co. 662
Saginaw, Michigan.
Gages, Measuring; Rules; Tapes, Measuring.

Lundie Engineering Corporation, The 575
19 West 50th St., New York City.
Rail Anchors; Tie Plates; Rail and Flange Lubricator.

Maintenance Equipment Co. 584
80 East Jackson Blvd., Chicago, Ill.
Car Stop, Friction; Curve Lubricators; Derails, Portable Rail Layers; Switchpoint Protectors.

Mall Tool Company 662, 665
7746 So. Chicago Ave., Chicago, Illinois.
Concrete Surfacers; Concrete Vibrators; Electric and Gas Engine Units; Lag Wrenches; Grinders, Rail; Portable Saws; Portable Drills.

Metal & Thermit Corporation 595
120 Broadway, New York City.
Thermit Welding; Welding Electrodes.

National Carbide Corporation 664
60 East 42nd Street, New York City.
Calcium Carbide; Carbide Lamps; Lights.

Nordberg Mfg. Co. 572
Milwaukee, Wisconsin.
Adzing Machines; Power Jacks; Rail Drills; Rail Grinders; Spike Pullers; Track Shifter; Track Wrenches.

Oxweld Railroad Service Company, The 576-577
230 No. Michigan Ave., Chicago, Ill.
Acetylene Appliances; Acetylene, Dissolved; Angle Bar Reconditioning Equipment; Calcium Carbide; Carbide Lanterns; Floodlights; Frog and Crossing Reconditioning Equipment; Gas, Acetylene, Gas Products; Generators, Acetylene, Carbic; Hard-Facing Materials; Oxygen; Oxy-acetylene, Cutting and Welding Equipment; Rail Bonding Equipment; Rail End Hardening Equipment; Rail Reconditioning Equipment; Rail Welding Equipment; Switch Point Reconditioning Equipment; Torches, Oxy-acetylene Cutting, Welding and Heat Treating; Welding Rods.

P. & M. Co. 569
80 East Jackson Boulevard, Chicago, Illinois.
Rail Anchors; Rail Anti-Creepers.

Pettibone-Mulliken Co. 580-581
4710 W. Division St., Chicago, Illinois.
Crossings, Permanent Base; Mechanical Switchman.

Q & C Co. 600
90 West St., New York City.
Anti-slip Rail Tongs; Car Replacers; Compromise Joints; Derails; Electric Snow Melters; Flangeway Brackets; Foot and Heel Guards; Gage Rods; Guard Rail Clamps; Insulated Rail Joints; One Piece Manganese Guard Rails; Rail Benders; Sentry Signal; Skid Shoes; Snow Flangers and Plows; Rail and Flange Lubricator; Switch Point Guards; Wheel Stops.

Rail Joint Co., Inc., The 579
50 Church St., New York City.
Compromise Joints; Insulated Rail Joints; Rail Joints; Step Joints.

Railroad Accessories Corporation 571
405 Lexington Ave., New York City.
Drills, Rail; Power Track Machine; Tie Boring Machine.

Rails Co., The 668
50 Church St., New York City.
Track Construction; Track Fastenings.

Railway Track-work Co. 663
3132-48 East Thompson Street, Philadelphia, Pennsylvania.
Abrasives; Cross Grinders; Rail Grinders; Rail Grinding Wheels and Blocks; Track Grinders.

Simmons-Boardman Publishing Co. 660, 662, 664
105 West Adams Street, Chicago, Illinois.

Sperry Rail Service 582-583
1505 Willow Avenue, Hoboken, New Jersey.
Detector Car Testing Rails in Track; Rail Butt Welding.

Tar and Chemical Division of Koppers Co. 589-590
See Koppers Co.

Templeton, Kenly & Co. 665
1020 So. Central Ave., Chicago, Illinois.
Jacks, Track; Rail Puller & Expanders.

Tennessee Coal, Iron & Railroad Company 586-587
Brown-Marx Building, Birmingham, Alabama.
See U. S. Steel Corporation Subsidiaries.

Timken Roller Bearing Company, The 578
Canton, Ohio.
Bearings, Hand Car, Journal Box, Motor, Push Car, Tapered Roller, Thrust; Steel, Electric Furnace, Open Hearth Special Analysis; Tubing, Seamless Steel.

Truscon Steel Company 598
Youngstown, Ohio.
Bunk Houses; Crossings, Highway; Parts, Shed; Platform Canopies; Slabs, Intertrack; Shop Buildings; Tool Houses; Transfer Sheds; Warehouses.

Union Carbide and Carbon Corporation 576-577
30 East 42nd Street, New York City.
See Oxweld Railroad Service Co.

U. S. Steel Corporation Subsidiaries 586-587
Alloy Steels; Bars; Bolts; Cement; Fencing; Fence Posts; GEO Track Construction; Guard Rails; Joint Fastenings; Nuts; Rail Joints; Rails; Screw Spikes; Sheet Piling; Steel Alloy; Steel Plates and Shapes; Structural Steel; Tee Rails; Tie Plates; Ties; Tubing; Wire and Wire Products.

United States Steel Products Company 586-587
60 Church Street, New York City.
See U. S. Steel Corporation Subsidiaries.

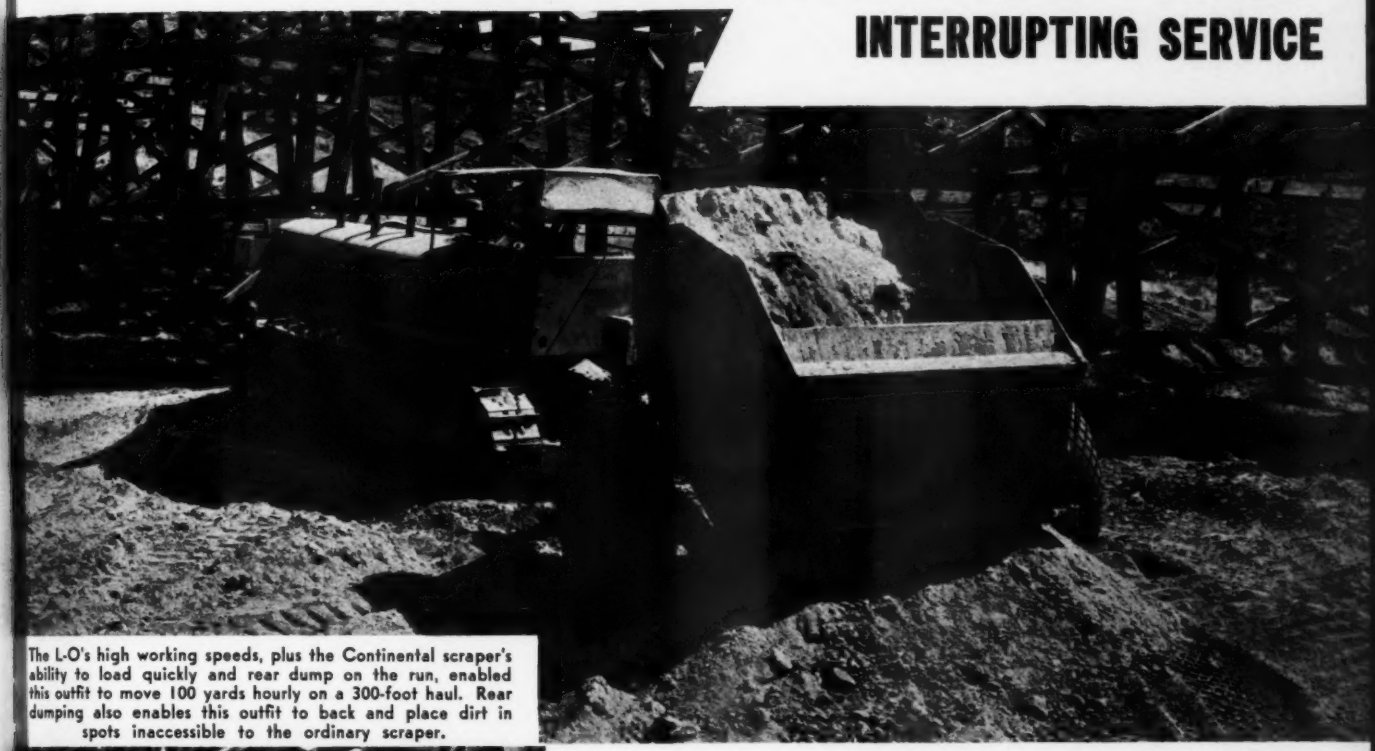
Warren Tool Corporation 585
Warren, Ohio.
Adzes; Bars; Chisels; Forgings; Mauls; Picks; Sledges; Track Tools; Wrenches.

Wood Preserving Corporation, The 589-590
See Koppers Co.

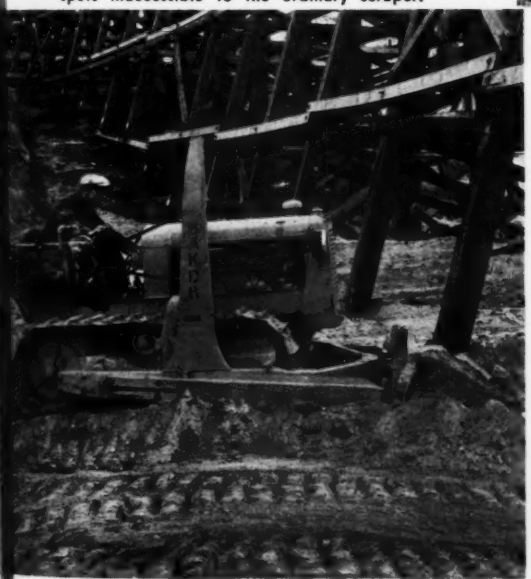
Woolery Machine Company 661
29th & Como Ave., S.E., Minneapolis, Minnesota.
Bearings, Axle; Cars, Inspection, Motor, Section; Engines, Gasoline, Motor Car; Tie Cutting Machine; Weed Burner.

FASTER POWER

SHOVES A FILL UNDER A TRESTLE WITHOUT INTERRUPTING SERVICE



The L-O's high working speeds, plus the Continental scraper's ability to load quickly and rear dump on the run, enabled this outfit to move 100 yards hourly on a 300-foot haul. Rear dumping also enables this outfit to back and place dirt in spots inaccessible to the ordinary scraper.



This M tractor and Baker bulldozer cleared brush and rocks from the borrow area to make scraper loading easier, then came down to spread the fill material between the trestle members.

To better its roadbed, regularly used by the Great Northern and the Union Pacific, the Oregon Trunk Line hired Hauser Construction Co. to replace a wooden trestle near Gateway, Oregon, with an earthen fill 550 feet long, 90 feet high and 250 feet wide at the base. 125,000 cubic yards of material had to be moved and placed exactly where the trestle stood. Pictures here show how the FASTER POWER of two A-C tractors handled the entire job—quickly and at low cost—all without interrupting the daily railway service.

Put fast-moving A-C equipment on your construction jobs. It works off the tracks—no interference with train schedules. It starts instantly and goes right to work—no waiting to get up steam. One man operates both tractor and tractor equipment—no big crew required. Operating and repair costs are remarkably low.

Compare A-C's FASTER POWER with other railway construction and maintenance equipment. Check working speeds, operating costs and new, reduced prices. Ask your Allis-Chalmers dealer for the facts.

Gasoline and Controlled Ignition Oil Track-Type Tractors from 32 to 80 Drawbar H. P. . . . . Tandem and Single Drive Speed Patrols . . . Drawn Blade Graders . . . Industrial Wheel Tractors . . . Stationary Power Units from 31 to 102 Brake H.P. . . . two, four and six-wheel scrapers, bulldozers, trailbuilders, loaders, winches and other allied equipment.

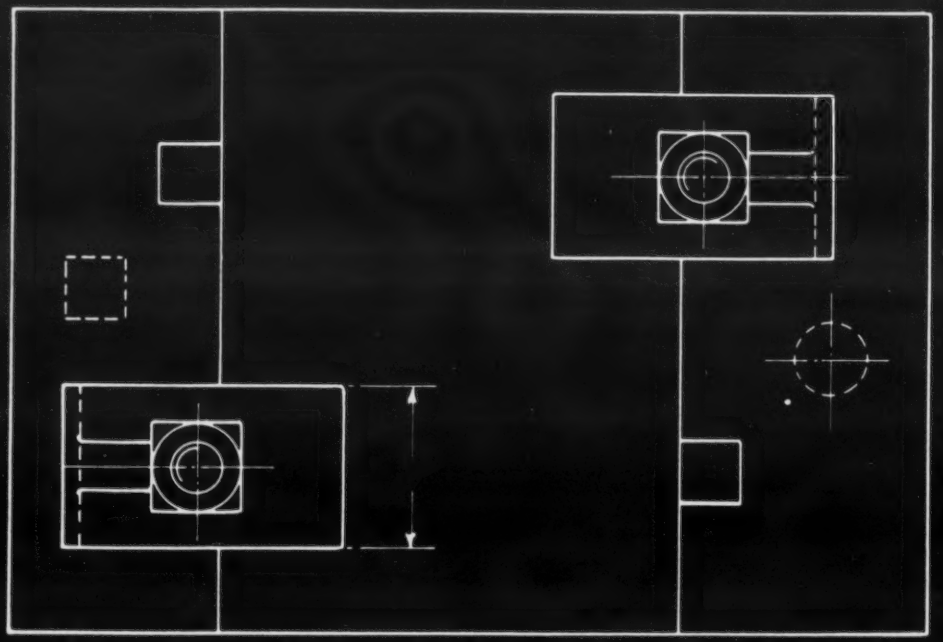
ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

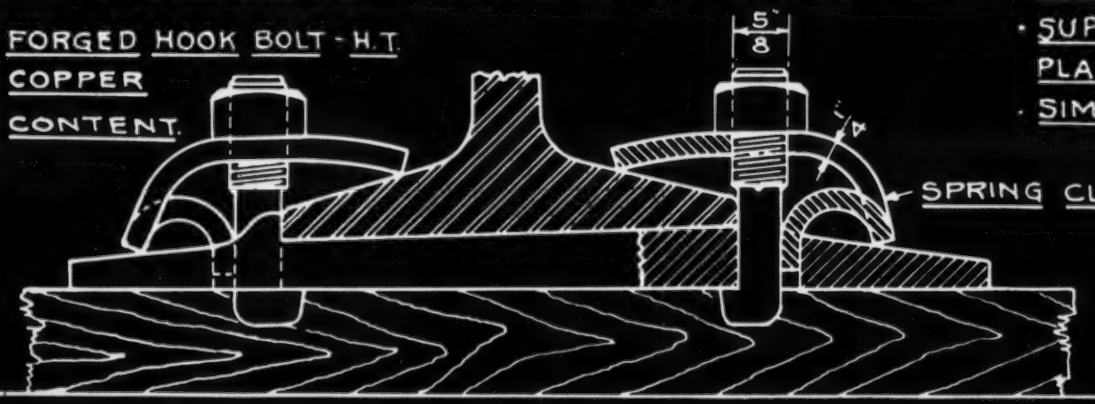
COMPRESSION RAIL FASTENER
TYPE · CL-16

THE RAILS COMPANY
NEW HAVEN CONN.

SCALE: 6" = 1 FT.	DRAWN BY: E.R.P.
DATE: 1-1-1937	CHECKED BY: "



USE EITHER CUT OR SCREW ANCHOR SPIKES.



—NOTES—

- FITS ALL STANDARD TIE PLATES.
- PREVENTS RAIL CREEPAGE IN BOTH DIRECTIONS.
- MAINTAINS DESIRED EXPANSION GAPS.
- PERMITS RAILS TO BE LAID TIGHT.
- FOR SINGLE OR DOUBLE SHOULDER TIE PLATES.
- AS MANY OR AS FEW PER PANEL CAN BE USED AS CONDITIONS NECESSITATE.
- SUPERIOR RESULTS AT INTERLOCKING PLANTS & ON BRIDGE DECKS.
- SIMPLE - EFFECTIVE - INEXPENSIVE.

PATENTS PENDING

DRAWING NO. RF-242